

	United States Department of Agriculture	Forest Service	Cherokee National Forest Watauga Ranger District 4400 Unicoi Drive Unicoi, Tennessee 37692	423-735-1500 (Voice) 423-735-7306 (Fax)
---	---	-------------------	---	--

Environmental Assessment

Stony Creek Project

*Watauga Ranger District
Cherokee National Forest
Carter County, Tennessee*

July 16, 2013



Responsible Official: Keith P. Kelley, District Ranger

For Information Contact: Jeff Chynoweth, NEPA Planner
Cherokee National Forest
Unaka Ranger District
4900 Asheville Hwy, SR70
Greeneville, TN 37743
(423) 638-4109

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, DC 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Document Structure

The Forest Service has prepared this Environmental Assessment (EA) in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations. The EA discloses the direct, indirect, and cumulative environmental impacts that would result from the proposed action and alternatives. The document is organized into six parts:

- Chapter 1: Purpose and Need - The section includes information on the history of the project proposal, the purpose of and need for the project and the agency's proposal for addressing the purpose and need. This section also details how the Forest Service informed the public of the proposal and how the public responded.
- Chapter 2: Alternatives considered, including the Proposed Action - This section provides a more detailed description of the agency's proposed action as well as alternative methods for achieving the stated purpose and need. The alternatives were developed based on issues raised by the public, other agencies and Forest Service personnel. Finally, Chapter 2 provides a summary table of each alternative's proposed actions.
- Chapter 3: Affected Environment and Environmental Consequences - This section examines the existing conditions in the project area and provides professional analyses of potential impacts of implementing the alternatives described in Chapter 2. The analyses are organized by Resource Area. For each analysis, effects of the No-Action Alternative are discussed first to provide a baseline for evaluation and comparison with other alternatives. The following resources are analyzed in Chapter 3: Soil and Water, Forest Resources, Health and Safety, Biological Resources, Scenery Resources, Recreation Resources, Cultural Resources, Climate Change, and Economics.
- Chapter 4: Literature Cited - This section provides a list of those documents specifically cited in the preparation of this assessment.
- Chapter 5: List of Preparers - This section provides a list of individuals who assisted in the development of the environmental assessment.
- Appendices - The appendices provide more detailed information presented in the environmental assessment.

Additional documentation may be found in the project planning record located at the Unaka District Office in Greeneville, Tennessee.

Table of Contents

Glossary, Acronyms and Abbreviations	5
Chapter 1: Purpose And Need For Action.....	10
Proposal	11
Goals and Objectives	11
Purpose and Need	12
Proposed Action	13
Decision to be Made	14
Public Involvement.....	14
Issues	14
Chapter 2: Alternatives including the Proposed Action	18
Alternative A (No Action).....	18
Alternative B: Proposed Action	18
Alternative C	22
Design Criteria	29
Comparison of Alternatives.....	30
Chapter 3: Affected Environment and Environmental Consequences	32
Soil and Water Resources.....	32
Forest Resources.....	49
Health and Safety	58
Biological Resources	61
Scenery Resources.....	112
Recreation Resources	120
Climate Change	123
Cultural Resources	127
Economics	127
Chapter 4: References Cited.....	130
Chapter 5: List of Preparers.....	136

Glossary, Acronyms and Abbreviations

36 CFR 800	Regulations implementing Section 106 of the National Historic Preservation Act, as amended
Acre (ac.)	A unit of land area equal to 43,560 ft ² (208.7 ft x 208.7 ft)
Acid Equivalent (a.e.)	The portion of a formulation that theoretically could be converted back to the corresponding or parent acid.
Alternative (Alt)	A mix of resource outputs designed to achieve a desired management emphasis as expressed in goals and objectives, and in response to public issues or management concerns.
AT (A.T.)	Appalachian Trail
Basal Area (BA)	The area of a given section of land that is occupied by the cross-section of tree trunks and stems at their base. Expressed as square feet per acre (ft ² /ac).
Biodiversity	The diversity of life in all its forms and all its levels of organization.
Biological Evaluation (BE)	A documented Forest Service review of its activities in sufficient detail to determine how an action may affect any proposed, threatened, endangered, or sensitive species.
Biomass	The total mass of living matter within a given unit of environmental area.
BMP	Best Management Practices
Breeding Habitat	A large area of essential habitat that provides for the biological needs of the species within its breeding range.
CCF	Hundred cubic feet of timber. 1 standard cord = 0.79 CCF.
CEQ (CEQ Regulations)	Council of Environmental Quality, established by the National Environmental Policy Act of 1969, for regulating how NEPA is to be implemented. The Council is part of the Executive Branch of Federal Government.
CFR	Code of Federal Regulations
CNF	Cherokee National Forest
Compartment	A portion of a forest usually one ownership, usually contiguous and composed of a variety of forest stand types, defined for purposes of location reference and as a basis for forest management. (The percentage of land owned by the U. S. Forest Service within any one compartment may vary from 0 to 100%).
Cultural Resource	Physical remains of districts, sites, structures, buildings, networks or objects used by humans in the past. They may be historic, prehistoric, archaeological, architectural, or spiritual in nature. Cultural resources are non-renewable.
Cumulative Effects	Past, present, and reasonably foreseeable effects (regardless of who or what has caused, is causing, and might cause these effects) analyzed together with the effects from the management actions.
Cx/Sy	Compartment x/Stand y (e.g. C100/S10)
Decision maker	Forest Supervisor or District Ranger
Decision Notice (DN)	The decision to implement or not implement an alternative for an Environmental Assessment is recorded in a Decision Notice.
Desired Condition	Description of land and resource conditions if all long-term goals are achieved.
DFC	Desired Future Condition (a.k.a. Desired Condition)

EA	Environmental Assessment
Early Successional Forest (ESF)	The biotic community that develops immediately following the removal or mortality of most or all the forest canopy, resulting in a predominance of woody species regeneration. As used in the RLRMP, a stand age of 0 to 10 years defines this condition.
Early Successional Habitat (ESH)	A vegetative condition typically characterized by low density to no tree canopy cover and an abundance of herbaceous and/or woody ground cover. This condition may include early-successional forest, maintained openings, pastures, balds, and open woodlands.
Ecosystem	All the interacting populations of plants, animals, and microorganisms occupying an area, plus their physical environment.
Effective treatment	An activity resulting in a full benefit at year 1, then declining linearly over time until there are minimal benefits. Varies depending on activity.
EHWA (a.k.a. HWA)	Eastern Hemlock Woolly Adelgid
EHWPF	Eastern Hemlock and White Pine Forest
EPA	Environmental Protection Agency
Erosion	The wearing away of the land's surface by running water, wind, ice, other geological agents, and human activity.
ESA	Endangered Species Act of 1973, as amended
Even-aged	The condition of a forest or stand composed of trees having no or relatively small differences in age.
FEIS	Final Environmental Impact Statement for the Cherokee National Forest' <i>Revised Land and Resource Management Plan</i> (USDA Forest Service 2004b).
Finding of No Significant Impact (FONSI)	A document that records the decision maker's conclusion that implementing an alternative would have no significant impact on the quality of the human environment, as defined in CEQ Regulations 1508.14.
Forest Plan	Short for the Cherokee National Forest' <i>Revised Land and Resource Management Plan</i> (USDA Forest Service 2004a).
FSR (a.k.a. NFSR)	Forest Service Road
GIS	Geographic Information System
Group Selection	An uneven-aged regeneration method in which trees are removed periodically in small groups, resulting in uneven age classes for trees established in the group.
Guideline	Preferable limit to management actions that may be followed to achieve desired conditions.
HESH	High Elevation Shrubby Habitat
Interdisciplinary Team (IDT)	A group of resource specialists who conducted the environmental analysis and who wrote this Environmental Assessment.
Issue	An environmental resource about which someone has a concern. <i>Issues</i> are identified in NEPA § 102(2) (E) as <i>unresolved conflicts</i> .
Land Class (LC)	The fitness of a given type of land for a defined use.
Large Woody Debris (LWD)	Any piece(s) of dead woody material, e.g. dead boles, limbs and large root masses (wads), on the ground in forest stands, or in rivers and streams.

Late Successional Forest (LSF)	The stage of forest development at which overstory trees have attained most of expected height growth and have reached ecological maturity. As used in the RLRMP, a stand age of greater than 80 years defines this condition.
LSOG	Late-successional and Old Growth
Management Indicator Species (MIS)	An animal or plant selected for use as a planning tool in accordance with 1982 NFMA regulations (36 CFR 219.19). These species are used to help set objectives, analyze effects of alternatives, and monitor plan implementation. They are chosen because their population changes are believed to indicate the effects of management on selected biological components.
Management Prescription Area (MPA)	Management practices and intensity selected and scheduled for application on a specific area to attain multiple-use and other goals and objectives. MPAs are defined in the RLRMP
MCF	Thousand Cubic Feet
MDF	Mesic Deciduous Forest
Mid-successional Forest (MSF)	The stage of forest development during which distinct overstory, midstory, and understory canopies are developed. As used in the RLRMP, a stand age of 41 to 80 years defines this condition.
Mitigation Measure	Actions to avoid, minimize, reduce, eliminate or rectify the impact of a management practice (a.k.a. design criteria).
Monitoring Report	The annual CNF Monitoring and Evaluation Report
National Environmental Policy Act (NEPA)	A public law that outlines specific procedures for integrating environmental considerations into agency planning, and requires analyzing possible environmental effects of any major action on public land, and the disclosure of the possible effects to the public and other agencies for review and comment.
Natural Regeneration	Tree seedlings that become established without artificial efforts.
NCT	No Conclusive Trend
NFMA	National Forest Management Act (36 CFR 219.27)
NFSR	National Forest Service Road (a.k.a. FSR)
NHPA	National Historic Preservation Act (Public Law 102-575, 16 U.S.C. 470)
NNIS	Non-Native Invasive Species
No Action Alternative	The most likely condition expected to exist in the future if current management direction continues unchanged; actions would be deferred; used as the baseline in evaluating possible effects of implementing the action alternatives.
NRHP	National Register of Historic Places
Objective	Concise, time-specific statement of measurable and planned results that respond to identified desired conditions; forms the basis for further planning; and are action items oriented and specifically describe measurable results.
OOPF	Oak and Oak-Pine Forest
OR	“Old” Road; an unauthorized road.
OUT	“Outlaw” Road; an unauthorized road
pH	A measure of acidity

Plantation	An area planted to trees, typically with a planting machine or by hand planting.
PNV	Present Net Value
PO	Permanent Opening
Preferred Alternative	The alternative (option/plan) that the decision maker plans to select near the end of the analysis process. This is not necessarily the selected alternative.
Prescribed fire	Deliberately ignited fire for the purpose of forest management, often to remove a heavy fuel buildup or simulate natural cycles of fire in an ecosystem.
Prescription Area (PA)	Portion of a landscape with similar management objectives and a common management prescription; prescription areas have specific direction regarding their desired condition, objectives, and Standards and Guidelines as provided in the RLRMP. (See also Management Prescription Area.)
Reforestation	To establish trees on a site by natural or artificial means.
Responsible Official	Forest Supervisor or District Ranger
RF	Riparian Forest
RLRMP	Cherokee National Forest <i>Revised Land and Resource Management Plan</i>
Road Maintenance Level	The established criterion that prescribes the intensity of maintenance necessary for the planning operation of a road. There are five levels from level 1 to level 5, with level 5 requiring the highest intensity of maintenance. See Appendix F of the RLRMP for details on level definitions.
Scenic Integrity Objective (SIO)	SIO guide the amount, degree, intensity, and distribution of management activities needed to achieve desired scenic conditions. Objectives range from very high to very low. See Appendix B in the RLRMP for objective definitions.
SDDW	Snags, Dens and Down Wood
Selected Alternative	The alternative (option/plan) that the decision maker selects to implement.
Self-sustaining	See Species Viability. Populations that are sufficiently abundant and have sufficient diversity to display the array of life history strategies and forms to provide for their long-term persistence and adaptability over time.
Sensitive Species	Plant and animal species identified by the Regional Forester for which population viability is a concern. These species are included in the Eastern Region Sensitive Species list.
Short and Long Term	Generally, short term means the duration of the activity plus a few months. Long term means after the short term, extending out to a specified number of years. Long term (and in some cases, short term) will differ for each resource (e.g. fire, heritage, wildlife, etc).
Slash	Limbs, branches and tops of trees left after timber harvest.
SMZ	Streamside Management Zone
Snag	A standing dead tree used by wildlife for breeding, roosting, perching and/or foraging purposes.
SPB	Southern Pine Beetle
SPF	Sapling/Pole Forest
Species Viability	A viable species consists of self-sustaining and interacting populations that are well distributed through the species' range.

Stand	A contiguous group of trees sufficiently uniform in species composition, arrangement of age classes, and condition to be a distinguishable unit.
Standard	A requirement found in the RLRMP, which impose limits on natural resource management activities, generally for environmental protection. Standards are required limits to activities.
State Historic Preservation Officer (SHPO)	The official appointed or designated pursuant to section 101(b) (1) of the National Historic Preservation Act to administer the State [Tennessee] historic preservation program or a representative designated to act for the State historic preservation officer.
Stocking density	Density of trees in an area, usually expressed in trees per acre.
Structural Diversity	The diversity in a community that results from having many horizontal or vertical physical elements (e.g. layers of canopy, supercanopy trees, down wood, etc.).
Suitable Habitat	Habitat able to support a reproducing subpopulation of a species.
TDEC	TN Department of Environment and Conservation
TES	Threatened, Endangered and Sensitive species
Trail	An existing one-track path or way of travel.
Treatment	An activity undertaken to modify or maintain the existing condition of the vegetation.
TWRA	TN Wildlife Resource Agency
Unsuitable Habitat	Habitat not able to support a reproducing subpopulation of a species.
USDA	United States Department of Agriculture
USDI	United States Department of Interior
User-created trail	A trail developed by users or use not maintained by the Forest Service.
USFWS	United States Fish and Wildlife Service
VC	Viability Concern species
Viable Population	A population that has the estimated numbers and distribution of reproductive individuals to ensure the continued existence of the species throughout its range.
Visual Absorption Capability	The physical capability of the land to support management activities and maintain visual integrity.
Visual Quality Objectives (VQOs)	VQO are based on physical and sociological characteristics of an area, and the degree of acceptable alterations of the characteristic landscape. Objectives include Preservation, Retention, Partial Retention, Modification, and Maximum Modification. See Appendix B in the RLRMP for objective definitions.
VMEIS	Vegetation Management Environmental Impact Statement
WLO	Wildlife Opening

Chapter 1: Purpose And Need For Action

The Cherokee National Forest (CNF) is proposing the Stony Creek Project on the Watauga Ranger District in the Holston Mountain area of Carter County to work toward the desired conditions for the project area, as directed in the CNF *Revised Land and Resource Management Plan* (RLRMP). The Stony Creek Analysis Area (SCAA; a.k.a. Stony Creek Watershed Area) totals approximately 51,726 acres. Table 1a shows the distribution of private and National Forest System lands (NFS) within the SCAA.

Table 1a: Distribution of Lands in the Stony Creek Analysis Area

Total Acres¹	Private (acres)	%	NFS (acres)	%
51,660	22,571	44%	29,089	56%

¹Acres reported in all tables are approximate

The RLRMP identifies goals and objectives to be implemented under various management prescriptions. The approximately 29,089 acres of National Forest System lands in the SCAA are distributed among 10 management prescriptions, with approximately 126 acres unclassified to a management prescription (Table 1b).

Table 1b: Management Prescriptions in the Stony Creek Analysis Area

Prescription	Description	Acres
1.A	Designated Wilderness (Big Laurel Branch)	4,391
1.B	Recommended Wilderness Study Area (Big Laurel Branch Addition)	2,808
4.A	Appalachian Trail Corridor	1,467
4.F	Scenic Areas	2,594
5.A	Administrative Sites	2
5.B	Electronic Sites	302
7.E.2	Dispersed Recreation Areas-Suitable	11,144
9.F	Rare Communities	118
12.A	Remote Backcountry Recreation – Few Open Roads	2,985
12.B	Remote Backcountry Recreation – Non-motorized	3,152
UNC	Unclassified	126
Total acres		29,089

Per the RLRMP, only the 7.E.2 prescription above is considered suitable for timber management. The prescription totals approximately 11,144 acres, of which 8,168 acres are in a Land Class Code (500s or 600s) considered suitable for timber production (Table 1c).

Table 1c: Acres by Suitable Prescription

Prescription	Total Acres	Suitable Acres*	Unsuitable Acres
7.E.2	11,144	8,168	2,976

* Total acres within the prescription having a suitable land class

The remaining approximately 20,906 acres or 73% of National Forest System lands within the SCAA are within prescriptions considered unsuitable for timber management (includes the unclassified NFS lands) or, if in a suitable prescription (i.e., 7.E.2), are in Land Class Codes without a primary or secondary timber production emphasis. These acres would continue to be managed per the management prescription direction found within the RLMP.

The Stony Creek Analysis Area is found within Management Area 12 and Management Area 13. The Management Areas (MA) are essentially split evenly within the SCAA, with the dividing line running along TN Highway 91. See pages 212-216 in the RLRMP for information on MA 12 and pages 217-221 for MA 13.

Proposal

The Stony Creek Project proposes to:

- Provide early successional forest habitat for wildlife,
- Release mast-producing trees,
- Maintain and create temporary roads,
- Improve wildlife habitat, and
- Authorize roads.

Goals and Objectives

Forestwide goals and objectives and Prescription Area goals and objectives, as found in the Cherokee National Forest (CNF) *Revised Land and Resource Management Plan* (RLRMP; USDA Forest Service 2004a), provide direction to steer an area toward its desired future condition. Comparison of these goals and objectives with an area's existing condition(s) helps to identify where efforts should be focused and management activities should take place. The following goals and objectives provide the management direction for the Stony Creek Project's proposed actions:

Forestwide Goals and Objectives

Goal 10: Maintain and restore natural communities in amounts, arrangements, and conditions capable of supporting viable populations of existing native and desired non-native plants, fish, and wildlife species within the planning area.

Goal 14: Contribute to conservation and recovery of federally listed threatened and endangered species, and avoid actions that would lead to federal listing of other species under the Endangered Species Act.

Objective 14.02: Provide upland water sources approximately every 0.5 miles, to provide an important habitat element for wildlife, including the endangered Indiana bat. Water sources are comprised of both permanent ponds and ephemeral pools and are often located in openings or near road corridors that allow access by bats.

Goal 16: Manage through protection, maintenance, or restoration, a variety of large, medium, and small old growth patches to provide biological and social benefits.

Goal 17: Restore and maintain forest communities to those plant communities predicted as most likely to occur based on the ecological potential of the site potential native vegetation.

Objective 17.01: Over the ten-year period restore at least 5000 acres of diverse native communities appropriate to sites currently occupied by white pine plantations.

Objective 17.02: Over the 10-year period restore oak or oak-pine forests on at least 9,000 acres of appropriate sites currently occupied by pine plantations or other sites with minimal diversity.

Goal 18: Contribute to maintenance or restoration of native tree species whose role in forest ecosystems is threatened by insects and disease. Management activities will reduce the impacts from non-native invasive species.

Objective 18.02: Promote the health of susceptible forest communities by maintaining a site-specific basal area that promotes tree vigor. Encourage advanced regeneration of oak species.

Goal 19: Where forest management activities are needed and appropriate to achieve the desired composition, structure, function, productivity, public health and safety, and sustainability of forest ecosystems; a result of such activities will also be to provide wood products for local needs.

Objective 19.01: Provide 33,726 MCF of sawtimber per decade.

Objective 19.02: Provide 6,242 MCF of pulpwood per decade.

Goal 40: Conserve, maintain, and enhance the scenic and aesthetic values of the CNF.

Goal 47: Construct, reconstruct and maintain roads to reduce sediment delivery to water bodies.

Goal 48: Provide a transportation system that supplies safe and efficient access for forest users while protecting forest resources. Emphasize acquisition of rights-of-way or fee-simple titles as appropriate to facilitate maintenance and meet access needs.

Prescription Area Objectives and Prescriptions (RX)

Objective 7.E.2-1.01: Manage forest successional stages to maintain a minimum of 50 percent of forested acres in mid- to late-successional forest, including old growth; a minimum of 20 percent of forested acres in late-successional forest, including old growth; and 4 to 10 percent in early-successional forest.

RX7E2-1: Creation of early-successional forest habitat is limited to 10 percent of forested acres. Existing patches of early successional forest greater than 2 acres in size are included when calculating allowable levels of early-successional forest creation.

RX7E2-2: This area is suitable for timber management.

Purpose and Need

The purpose of the Stony Creek Project is to work toward the desired condition for the project area, as directed in the RLRMP (pages 131-133 and 212-221). The project area, as defined here,

are the National Forest System lands within the Stony Creek Analysis Area.

- GIS (using 2013 as the base year) and field studies identified zero acres of National Forest System land currently providing early successional habitat (per the RLRMP, stands of 0 to 10 years old) in the project area. The RMRMP contains objectives for a minimum (4%) and maximum (10%) percentage of early successional habitat to provide/maintain in the 7.E.2 prescription (Prescription Objective 7.E.2-1.01 and RX7E2-1).

Wildlife species including chestnut-sided warbler, black bear, white-tail deer, ruffed grouse, and wild turkey, utilize this habitat stage. As early successional forest habitat availability declines, so do their populations. Therefore, there is a need to create early successional forest habitat in the Stony Creek Project area (Forestwide Goals 10 and 19 and Objectives 19.01 and 19.02, and Prescription Objective 7.E.2-1.01).

- Mast-producing trees are being out-competed by shrubs and non-mast producing tree species in previously regenerated stands. There is a need to release the mast-producing trees to ensure that they continue to be a component of mature and maturing stands in the Stony Creek project area (Forestwide Goals 10 and 17, and Objectives 17.02 and 18.02).
- Prior to proposed timber harvest activities, maintenance of approximately 6.3 miles of authorized road, and the construction of 1.5 miles of temporary road are needed to provide for the removal of forest products from areas harvested for timber (Forestwide Goal 19).
- Maintenance of approximately 6.3 miles of roads would help reduce sediment transport into streams and other water bodies caused by erosion (Forestwide Goal 47).
- Adequate watering holes for wildlife are limited, as are wildlife habitat structures, e.g. cavity nesting sites and drumming logs, in the area. There is a need to improve and/or provide for these habitat components in order to sustain or promote viable populations of wildlife species (Forestwide Goals 10 and 14, and Objective 14.02).
- There are 8.2 miles of road that need to be either decommissioned if not needed for resource management or converted to system roads (Goal 48).

Commercial timber harvest and noncommercial vegetation management treatments may be used to accomplish vegetation management objectives for early successional forest creation in Prescription Area 7.E.2.

After reviews, District personnel found that the above Goals and Objectives are not being fully realized in the Stony Creek project area. The Need for Action responds to the Goals and Objectives as outlined above, and helps move the project area towards the desired conditions as described in the RLRMP.

Proposed Action

This is a general summary of the proposed action, which are described in more detail

in Alternative B found in Chapter 2. The actions proposed by the Forest Service to meet the Purpose and Need are:

1. Create 383 acres (11 stands) of early successional forest habitat. Approximately 351 acres (10 stands) would be treated through a commercial timber harvest, with approximately 32 acres (one stand) treated noncommercially. All 11 stands would require site preparation and release treatments.
2. Provide for the release of mast-producing trees on approximately 13 acres (2 stands).
3. Maintain approximately 6.3 miles of prehaul road, and construct 1.5 miles of temporary road in support of items 1 and 2.
4. Improve wildlife habitat conditions through the placement of nest boxes and bat roost boxes, providing drumming logs, and the construction of waterholes.
5. Authorize approximately 8.2 miles of unauthorized road.

Decision to be Made

The decision to be made by the Deciding Official is whether to implement the Proposed Action (Alternative B), an Alternative to the Proposed Action, or to continue with existing management under the No Action Alternative. This Environmental Assessment (EA) analyzes the site-specific effects of management activities as proposed in the Stony Creek Project, and is tiered to the RLRMP, FEIS, and accompanying Record of Decision.

Public Involvement

The proposed action was provided to the public and other agencies for comment during scoping: November 5 to December 5, 2012. One hundred twenty letters were sent out to individuals, public and private agencies and organizations, and tribal governments; 44 responses were received. The proposal has been published in the Schedule Of Proposed Actions since October, 2012. Using comments from the public and other agencies, the Interdisciplinary Team developed a list of issues to address.

Issues

Sixty-nine comments were derived from the 44 responses received during scoping. Fifty seven comments fell into one or more of the following categories: 1) outside the scope of the proposed action; 2) already decided by law, regulation, Forest Plan, or other higher level decision; 3) not relevant to the decision to be made, 4) conjectural and not supported by scientific or factual evidence; 5) general comment, suggestion, opinion, or position statement; 6) other agency or partners consultation, review, advice, recommendations, etc.; 7) already considered in the proposed action; and/or 8) is standard procedure. All 57 comments were eliminated from detailed study in this Environment Assessment.

The remaining 12 comments were specific to the project, with seven issues developed from the comments.

SC 9. Early Successional Habitat

The issue regarding the need for early successional forest habitat (ESFH) within the Stony Creek Project area was brought up by the public. The need was also internally derived by the Cherokee National Forest North Zone Interdisciplinary Team.

Response: A GIS analysis identified no acres of National Forest System land currently providing early successional forest habitat (per the RLRMP, stands of 0 to 10 years old) in the project area. The GIS analysis used 2013 as a base year. Per the RLRMP, Prescription Area 7.E.2 has an early successional forest objective of from 4% - 10%. By treating stands that qualify for regeneration, the Stony Creek Project would result in about 5% early successional forest within the project area. This would help meet the RLRMP objective for early successional forest.

SC 10. Old Growth Stands

Several commenters recommended that Stand 40 in Compartment 66, and Stands 5 and 30 in Compartment 68 be dropped from early successional habitat creation based on their being Old Growth. [Multiple commenters]

Response: According to the RLRMP, there is no existing designated Old Growth in the Stony Creek project area.

Regarding the three stands: The stands' ages given in Table 3 of the Stony Creek Project Scoping Letter dated October 24, 2012 were derived from GIS data. It was discovered after the scoping letter had been sent out to the public that the ages were miscalculated, and were likely much younger. Data collected in the field, however, determined their ages to be only slightly younger than that initially reported (see Table below; J. Kincaid, CNF Forester, pers. comm. 2013).

Table: Stand Ages

Compartment	Stand	Age ¹	Age ²
66	40	132	125
68	5	162	150
68	30	162	150

¹ Age as reported in Scoping Letter

² Age as determined from field data

After an additional review of the Old Growth tally sheets for the three stands, and a field visit with Josh Kelly (Western North Carolina Alliance), Sam Evans (Southern Environmental Law Center), Bob Lewis (Forest Service), Jeff Kincaid (Forest Service) and Jim Stelick (Forest Service) on May 15, 2013, it was determined that the three stands in question did meet the criteria in the Old Growth Guidance to be considered Old Growth. Subsequently, the stands will be dropped from early successional forest creation in any alternative(s) to the Proposed Action developed.

SC 11. Compartment 67, Stand 2

The commenters wondered if the specified age of the stand may have been in error; that it is 128 years old instead of 28 years old (as reported in the scoping letter). At the age reported, they felt the stand would be of uncertain commercial value. [Murry et al Letter of 2/29/2012, p. 2.]

Response: The stand's age given in Table 3 of the Stony Creek Project Scoping Letter was derived from GIS data. Data collected in the field has determined that Stand 67-2 is 47 years old (J. Kincaid, CNF Forestry Technician, pers. comm. 2013). In addition, the stand's forest type should have been reported as 'White pine' and not 'White oak - Northern red oak – Hickory'.

SC 12. OR-7 and OR-8

The commenter states: "In the project area no roads are being decommissioned but 8.2 miles are being authorized. You give the reason for this authorization as power line access except for two roads OR-7 and OR-8. Please inform us: why are OR-7 and OR-8 being authorized?" [Murry et al Letter of 2/29/2012, p. 3]

Response: Adding the two roads to the system was based on the recommendations and the results of the Stony Creek Travel Analysis Process:

- OR-7 is proposed to be added to the system to provide access to the Dip Site Pond for fire emergencies.
- OR-8 is proposed to be added to the system for power line access and emergency traffic to the Blue Hole recreation site.

SC 13. CNF Landscape Restoration Initiative

The commenter stated: "Through the CNF Landscape Restoration Initiative ("CNFLRI") for the northern districts of the forest, restoration needs have been further studied and identified. In the CNFLRI materials, the agency already has information about this watershed that is relevant to its existing conditions, to the effects of the proposal, and to ecological restoration alternatives. Under NEPA, in its environmental analysis, the agency must forthrightly disclose and consider that information and must consider the reasonable, viable ecological restoration alternatives based upon it." [Irwin et al Letter of 12/5/2012, p. 3]

Response: A copy of the CNFLRI report is included in the project record. In the section entitled "Purpose of the Report" (pp. 3-4) it states the following:

- "The work of the CNFLRI committee does not replace or have authority over the existing Forest Management Plan for the Cherokee National Forest..."
- "... the CNFLRI is developing better data about existing forest conditions, determining needs for restoration efforts and suggesting ideas for how restoration projects could be achieved. All of this work will operate within and under the dictates of the current adopted forest plan."
- "The committee will work collaboratively with the Cherokee National Forest to identify and prioritize the needs for restoration...Results will be compiled and presented as a set of recommendations to the Cherokee National Forest and will hopefully be considered as part of the future management decision."

The Forest shall take into consideration the CNFLRI report as well as other documents used for best available science in the development of project alternatives and their respective analyses.

SC 14. Maintained and temporary roads impacting system trails

The commenter stated that the following temporary trails [roads] would “severely impact” system trails: Temporary road to stand 72-15 appears to be over Trail 2025 (Taylor Ridge Trail); temporary road to stand 71-8 appears to be at least partially coincident with Trail 2022 (Bartee Trail); and pre-haul maintenance of Road 60682 appears to be coincident with the multi-use (foot, equestrian, and mountain bike) Trail 2026A (Furnace Branch Trail). [Irwin et al Letter of 12/5/2012, p. 6]

Response: Temporary road to stand 72-15: The proposal is to use Forest Service Road 4071 up to the junction with trail 2025. A landing would be placed on Road 4071 with the existing trail being used as a skid road. It should be noted that although currently a Forest Service system trail, the footprint of trail 2025 follows an old skid/temporary road. The proposal is to temporarily re-open the old skid road (trail 2025) to facilitate logging, then, after project completion, to close the temp road, water bar it, reseed and fertilize it, and allow the road to return to its previous trail function.

Temporary road to stand 71-8: Trail 2022 passes through the NE corner of stand 71-8 where few acres of ESH creation are proposed. Harvest activities would not cross the trail. The temporary access road would be constructed on the south side of the stand. The temporary road would not be “coincident” with the trail, but would cross the trail at one junction. The rest of the trail in the vicinity of the temp road would not be impacted. The temp road would be closed, then rehabilitated (see temp road to stand 72-15 above), including where the temp road crosses with the trail, after project completion.

Pre-haul Maintenance on 60682: The proposal is to do pre-haul, during haul and post maintenance on road 60682 to facilitate logging. As with the temporary road to stand 72-15, the road would be closed and seeded after project completion, and then allowed to return to its previous trail function.

SC 15. Noncommercial treatments

The commenter suggested that “noncommercial treatments in recently logged stands, for example, could create the same [early successional habitat] benefits for wildlife.”

Response: The Stony Creek project proposes noncommercial treatments in previously logged stands as Crop Tree Release (see Scoping Letter, action item #2). In this treatment, the FS would release a single tree every 20 feet within two stands (total 13 acres). The resulting gap, however, would not provide adequate light and/or space to create ESH. In addition, the temporary gap would quickly be filled in by neighboring trees. While the treatment would provide a more open habitat, it would not provide the same benefits to wildlife that utilize early successional forest.

From the discussion above, the following issues were considered to be directly or indirectly caused by implementing the Proposed Action:

SC 9. Lack of Early Successional Habitat

SC 10. Old Growth Stands

Content Analysis of the scoping comments, comment disposition, and issue development can be found in Appendix B. The original letters are located in the project file.

Chapter 2: Alternatives including the Proposed Action

Chapter 2 describes the No Action, the Proposed Action and Alternatives to the Proposed Action. It includes a description of each alternative considered in this analysis. This section also presents the alternatives in comparative form, defining the differences between each alternative and providing a clear basis for choice among options by the decision maker and the public. This comparison is based on the actions and issues identified in Chapter 1. Each alternative is designed to reduce adverse impacts to resources.

Acreages, mileages, and volumes are based on the best information available (Geographical Information Systems (GIS), Stand Maps, etc.). Actual quantities would be determined during on-the-ground project layout. Percentages stated may vary slightly due to rounding. Stand ages are, unless otherwise stated, as of the year 2013, and are based on the preponderate age of dominant and co-dominant trees.

Alternative A (No Action)

This alternative responds to National Environmental Policy Act requirements [40 CFR 1502.14(d)] for a No Action Alternative. Selection of this alternative means no projects would be implemented in the project area at this time. Current uses of the area would continue until such uses were prohibited by changed environmental conditions.

Selection of Alternative A does not preclude future analysis or implementation of on-going management proposals within the project area. This alternative provides a baseline used to compare the environmental effects of the action alternatives.

Alternative B: Proposed Action

This alternative is designed to move the Stony Creek project area from the current condition toward the desired future condition, as described in the RLRMP.

1. Provide Early Successional Forest Habitat

Approximately 383 acres of early successional forest habitat (ESFH) would be created for wildlife habitat needs in the Stony Creek Project area. The 383 total acres equals approximately 4.7% of the suitable acreage (Table 2a; Appendix A, Maps A-1 and A-2).

Table 2a: Acres by Suitable Prescription

Prescription	Total Acres	Suitable Acres*	Acres Treated	Percent of Prescription	ESF Objective in RLRMP
7.E.2	11,144	8,168	383	4.7%	4% - 10%

* Total acres within the prescription having a suitable land classification.

Approximately 351 acres (10 stands) would be regenerated utilizing commercial timber harvest through a Two-Age Regeneration Harvest (Shelterwood with Reserves). Approximately 32 acres (Compartment 71, Stand 29) would be regenerated noncommercially (Table 2b).

Table 2b: Early Successional Forest Habitat

Prescription	Compartment	Stand	Acres	Age	Forest Type
7.E.2	66	40	39	125 ¹	White oak - No. red oak - Hickory
7.E.2	67	2	30	47 ²	White oak - No. red oak - Hickory
7.E.2	67	7	10	97	Cove hardwood - White pine - Hemlock
7.E.2	67	18	40	95	White oak - No. red oak - Hickory
7.E.2	68	5	40	150 ¹	Chestnut oak - Scarlet oak
7.E.2	68	30	39	150 ¹	Chestnut oak - Scarlet oak
7.E.2	71	1	37	107	White oak - No. red oak - Hickory
7.E.2	71	8	36	87	White oak - No. red oak - Hickory
7.E.2	71	29	32	110	White oak - No. red oak - Hickory
7.E.2	72	15	40	100	Northern red oak
7.E.2	73	17	40	93	Chestnut oak - Scarlet oak
Total acres			383		

¹ The age for Stand 40 in Compartment 66 and Stands 5 and 30 in Compartment 68 differs from that reported in the Stony Creek Project scoping letter of 10/24/2012 (Jeff Kincaid, CNF Forester, pers. comm. 2013).

² The age for Stand 2 in Compartment 67 differs from that reported in the Stony Creek Project scoping letter of 10/24/2012 (Jeff Kincaid, CNF Forester, pers. comm. 2013).

An average basal area of 15-25 ft²/acre of shelterwood reserve trees would be left on site to create a two-aged stand structure along with new regeneration. Merchantable trees would be marked for removal. Favored reserve trees include trees with dens, large and long-lived mast-producing trees and long-lived yellow pine. Likely species to leave would include black gum, white oak, red oak, hickory, chestnut oak and shortleaf pine. Each stand would be variable density marked resulting in areas of higher basal area where favorable leave trees may be clumped. Areas where fewer favorable leave trees occur may result in lower basal area, but the overall stand basal area would be between 15-25 ft²/acre.

All stands in Table 2b would require pre- and post-harvest site preparation and timber stand improvement release treatments (also see Appendix C–Herbicide Use Assumptions):

- Pre-harvest site preparation: Prior to harvest, midstory species would be treated with an herbicide (Imazapyr and Glyphosate) to reduce post-harvest sprouting of overly-competitive species. Major species targeted for treatment include red maple, white pine and rhododendron between 1 to 7 inches DBH. Treatment would occur 1-3 years prior to harvest, where applicable. Species not treated include dogwood and hard- and soft-mast producing species.
- Post-harvest Site Preparation for Natural Regeneration: Following logging, site preparation would include mechanical slash down (chainsaw) and/or herbicide treatment (Imazapyr and Glyphosate) of residual species between 1 to 7 inches DBH. Major species targeted for treatment include red maple, white pine and rhododendron. Treatment would occur 1-2 years post harvest, where applicable. Species not treated include dogwood and hard- and soft-mast producing species.

- Timber Stand Improvement (TSI) Release Treatment: The need for TSI release would be determined after Post-harvest Site Preparation. Where needed, two to four years following harvest, overly-competitive sprouts would be treated using herbicides (Triclopyr). This would help to control competition from red maple, yellow poplar and other species.

Seedlings of blight resistant American chestnuts and/or red oak would be planted in regenerated areas, if seedlings become available.

2. Crop Tree Release

Use mechanical treatment methods (e.g. chainsaw) on approximately 13 acres (two stands) to select and provide for the release of mast-producing trees (Table 2c, App. A, Map A-2).

Table 2c: Crop Tree Release Acres

Compartment	Stand	Acres	Forest Type
69	25	4	Yellow poplar – White oak – No. red oak
69	28	9	White oak - No. red oak - Hickory
Total Acres		13	

3. Maintain Roads and Create Temporary Roads

Approximately 6.3 miles of existing road would be improved and maintained in support of timber sale activities (Table 2d). Improvement/maintenance activities include gravel placement and road grading. Upon completion of the project, 60682 would be closed and seeded, then allowed to return to its previous multi-use trail (2026A) function.

Approximately 1.5 miles of temporary road would be constructed to provide access to treatment stands (Table 2d; App. A, Maps A-1 and A-2). Temporary roads would be closed, stabilized, water barred (where needed), and seeded and fertilized following completion of timber sale. Where a temporary road is located within or crosses an existing Forest Service trail, the temporary road would be closed and rehabilitated as above, then allowed to return to its previous trail function.

Table 2d: Maintained and Temporary Roads

Road #	Road Name	Miles	Action
316	Bartee Branch	0.60	Pre-Haul Maintenance
316A	Sam's Cove	1.01	Pre-Haul Maintenance
5081	Griffith Branch	4.24	Pre-Haul Maintenance
60682	Furnace Branch	0.47	Pre-Haul Maintenance
Total miles		6.32	
Temporary Road to Comp 66, Stand 40		0.28	Temporary Construction
Temporary Road to Comp 68, Stand 5		0.63	Temporary Construction
Temporary Road to Comp 71, Stand 8		0.23	Temporary Construction
Temporary Road to Comp 72, Stand 15		0.35	Temporary Construction
Total miles		1.49	

4. Improve Wildlife Habitat

The following are proposed to improve habitat conditions for terrestrial wildlife (Table 2e):

- Boxes – place roost boxes for bats and nest boxes for birds and small mammals. Two boxes are placed in stands proposed for early successional forest habitat creation.
- Water – construct waterholes, vernal (ephemeral) ponds/pools, or wetlands (~ 1/8th acre) for aquatic insects, amphibians, bats and other wildlife. The type(s) of water resources constructed would vary depending on the current availability of water sources and wildlife needs in the treatment area.
- Logs – provide up to five drumming logs (eight inches or greater in diameter) for ruffed grouse in stands proposed for early successional forest habitat creation.

Table 2e: Terrestrial Wildlife Activities

Location	Boxes (each)	Water (feature)	Logs (each)
Compartment 66	4	0	10
Compartment 67	4	1	10
Compartment 68	2	0	5
Compartment 71	4	1	10
Compartment 72	2	0	5
Compartment 73	2	0	5
Total	18	2	45

5. Roads to be Authorized

Approximately 8.2 miles of roads would be authorized (Table 2f; App. A, Map A-6), per the recommendations in the Stony Creek Travel Analysis Plan. All roads already exist on the ground with all but OR-7 and OR-8 to account for powerline access. OR-7 is proposed to be added to the system to provide access to the Dip Site Pond for fire emergencies. OR-8 is proposed to be added to the system for power line access and emergency traffic to the Blue Hole recreation site.

Table 2f: Roads to be Authorized

Road #	Proposed FSR Road Name	Proposed FSR#	Miles
OR-1	Horselog Branch	60601	0.47
OR-2	Grindstaff Branch Extension	6059	0.27
OR-3	Grindstaff Branch Spur B	6059B	0.28
OR-4	Elliott Hollow Extension	60591	2.46
OR-5	Hurley Branch	60581	2.78
OR-6	Miller Branch Special Use	60701	0.02
OR-7	Hinkle Branch Spur A	60681A	0.39
OR-8	Blue Hole	60721	0.11
OR-9	Fork Ridge	60722	1.27
OR-10	Edwards Tract	60552	0.12
Total Miles			8.17

Alternative C

Alternative C reduces the total acres of early successional forest habitat created, and reduces the miles of temporary road construction. Alternative C increases the total acres of herbicide use.

Alternative C adds 116 acres of midstory treatment, 204 acres of thinning treatment, and 1,057 acres of prescribed burning. These additional treatments would help meet the following Purpose and Need and Forestwide Goals and Objectives:

- Mast-producing trees are being out-competed by shrubs and non-mast producing tree species in previously regenerated stands. There is a need to release the mast-producing trees to ensure that they continue to be a component of mature and maturing stands in the Stony Creek project area (Forestwide Goals 10 and 17, and Objectives 17.02 and 18.02: See pages 11-12 of this EA for a description of the Goals and Objectives).
- In previously regenerated stands the trees are being out-competed for limited resources, such as soil nutrients, space, and water. There is a need to reduce competition to promote the health of the forest and tree vigor in the Stony Creek project area (Forestwide Goal 19, and Objective 18.02: See pages 11-12 of this EA for a description of the Goals and Objectives).
- Understory competition is preventing the natural regeneration of oaks and pines and reducing the production of wildlife forage. There is a need to maintain natural fire dependent species and associated communities, to improve general forest health, and to improve wildlife forage and foraging habitat in the Stony Creek project area (Forestwide Goals 10, 17, 18, and 21, and Objectives 18.02, 21.02, and 21.04: See pages 11-12 of this EA for description of Goals 10, 17, and 18, and Objective 18.02).
 - Goal 21: Use fire during dormant and growing seasons to achieve ecological sustainability, rehabilitation, and restoration of fire dependent and associated communities. Identify and establish appropriate “burning blocks” that facilitate the use of prescribed fire to maintain and restore fire dependent and associated communities.
 - Objective 21.02: Prescribe burn an average of at least 5,200 acres per year of oak and oak-pine forests in an effort to maintain a 4-12 year fire return cycle.
 - Objective 21.04: Prescribe burn an average of at least 1,200 acres per year of pine-oak forests in an effort to maintain a fire return cycle of 4-12 years.

The proposed burn blocks are in Prescription Area 7.E.2 which permits the use of prescribed fire to meet RLRMP objectives.

Finally, Alternative C adds decommissioning the approximately 5.2-mile section of Little Stony Road (FSR 202A) on NFS lands, converting a portion of the roadbed to a fishing/hiking trail, obliterating/recontouring portions of the roadbed, constructing a horse trail, installing two gates, and creating a small parking lot. This would help meet the following Purpose and Need and Forestwide Goals and Objectives:

- There are approximately five miles of system roads in the area that are not needed for resource management and need to be decommissioned (Forestwide Goals 48 and 49, and Objective 49.01: see page 12 for a description of Forestwide Goal 48).
 - Goal 49: Decommission unneeded roads.
 - Objective 49.01 Decommission unneeded roads that are identified through an interdisciplinary process.
- Goal 30: Provide a spectrum of high quality nature-based recreation settings and opportunities that reflect the unique or exceptional resources of the CNF and the interests of the recreating public on an environmentally sound and financially sustainable basis. Adapt management of recreation facilities and opportunities as needed to shift limited resources to those opportunities.
- Goal 31: Where financially and environmentally feasible, enhance the following opportunities: water-based activities, sightseeing, camping, hunting, fishing, driving for pleasure, wildlife viewing/nature study, day-use and group facilities, non-motorized trail systems for hiking, biking, and equestrian use, designated OHV routes, special interest areas, interpretation and conservation education.

Alternative C Actions

1. Provide Early Successional Forest Habitat

Approximately 335 acres of early successional forest habitat (ESFH) would be created for wildlife habitat needs in the Stony Creek Project area. The 335 acres of ESHF proposed equals approximately 4.1% of the suitable acreage (Table 2g; App. A, Maps A-3 and A-4).

Table 2g: Acres by Suitable Prescription

Prescription	Total Acres	Suitable Acres	Acres Treated	Percent of Prescription	ESH Objective in RLRMP
7.E.2	11,144	8,168	335	4.1%	4% - 10%

Approximately 303 acres (10 stands) would be regenerated utilizing commercial timber harvest through a Two-Age Regeneration Harvest (Shelterwood with Reserves). Approximately 32 acres (Compartment 71, Stand 29) would be regenerated noncommercially (Table 2h).

Table 2h: Early Successional Forest Habitat acres

Prescription	Compartment	Stand	Acres	Age	Forest Type
7.E.2	67	2	30	47	White oak - No. red oak - Hickory
7.E.2	67	7	10	97	Cove hardwood - White pine - Hemlock
7.E.2	67	18	40	95	White oak - No. red oak - Hickory
7.E.2	68	12	23	96	White oak - No. red oak - Hickory
7.E.2	69	11	40	96	Chestnut oak - Scarlet oak

Prescription	Compartment	Stand	Acres	Age	Forest Type
7.E.2	69	35*	7	96	White oak - No. red oak - Hickory
7.E.2	71	1	37	107	White oak - No. red oak - Hickory
7.E.2	71	8	36	87	White oak - No. red oak - Hickory
7.E.2	71	29	32	110	White oak - No. red oak - Hickory
7.E.2	72	15	40	100	Northern red oak
7.E.2	73	17	40	93	Chestnut oak - Scarlet oak
Total acres			335		

* Stand 35 is a new stand created by combining portions of stands 3 and 15

An average basal area of 15-25 ft²/acre of shelterwood reserve trees would be left on site to create a two-aged stand structure along with new regeneration. Merchantable trees would be marked for removal. Favored reserve trees include trees with dens, large and long-lived mast-producing trees and long-lived yellow pine. Likely species to leave would include black gum, white oak, red oak, hickory, chestnut oak and shortleaf pine. Each stand would be variable density marked resulting in areas of higher basal area where favorable leave trees may be clumped. Areas where fewer favorable leave trees occur may result in lower basal areas, but the overall stand basal area would be between 15-25 ft² /acre.

All stands in Table 2h would require pre- and post-harvest site preparation and timber stand improvement release treatments (also see Appendix C – Herbicide Use Assumptions):

- Pre-harvest site preparation: Prior to harvest, midstory species would be treated with an herbicide (Imazapyr and Glyphosate) to reduce post-harvest sprouting of overly-competitive species. Major species targeted for treatment include red maple, white pine and rhododendron between 1 to 7 inches DBH. Treatment would occur 1-3 years prior to harvest, where applicable. Species not treated include dogwood and hard-and soft-mast producing species.
- Post-harvest Site Preparation for Natural Regeneration: Following logging, site preparation would include mechanical slash down (chainsaw) and/or herbicide treatment (Imazapyr and Glyphosate) of residual species between 1 to 7 inches DBH. Major species targeted for treatment include red maple, white pine and rhododendron. Treatment would occur 1-2 years post harvest, where applicable. Species not treated include dogwood and hard- and soft-mast producing species.
- Timber Stand Improvement (TSI) Release Treatment: The need for TSI release would be determined after Post-harvest Site Preparation. Where needed, two to four years following harvest, overly-competitive sprouts would be treated using herbicides (Triclopyr). This would help to control competition from red maple, yellow poplar and other species.

Blight resistant American chestnuts and/or red oak would be planted in regenerated areas, if seedlings become available.

2. Crop Tree Release

Use mechanical treatment methods (e.g. chainsaw) on approximately 13 acres (two stands) to select and provide for the release of mast-producing trees (Table 2i; App. A, Map A-3).

Table 2i: Crop Tree Release Acres

Compartment	Stand	Acres	Forest Type
69	25	4	Yellow poplar – White oak – No. red oak
69	28	9	White oak - No. red oak - Hickory
Total Acres		13	

3. Midstory

Stocking density of understory and midstory on 116 acres (three stands; Table 2j; App. A, Map A-3) would be reduced by about 25 percent using herbicides (Imazapyr and Glyphosate). The reduction in competition and increased sunlight would promote the development of mast-producing species.

Table 2j: Midstory Acres

Compartment	Stand	Acres	Forest Type
68	25	16	White oak - No. red oak - Hickory
68	28	39	White oak - No. red oak - Hickory
68	29	61	White oak - No. red oak - Hickory
Total acres		116	

4. Thinning

Commercially thin approximately 204 acres (six stands) to help restore upland oak and shortleaf pine forest (Table 2k; App. A, Map A-3).

Table 2k: Thinning Acres

Compartment	Stand	Acres	Forest Type
68	13	8	Chestnut oak – Scarlet oak – Yellow pine
69	12	48	White oak – No. red oak – Hickory
69	14*	48	Chestnut oak – Scarlet oak – Yellow pine
69	15	27	White oak – No. red oak – Hickory
69	17	40	White oak – No. red oak – Hickory
69	37*	33	Chestnut oak – Scarlet oak – Yellow pine
Total acres		204	

*Stand 14, as found in GIS, was split to create stand 14 and stand 37

Stands would be thinned to a final basal area ranging from 35 to 60 ft² /acre. Merchantable trees would be marked for removal. Priority for removal would first be damaged and diseased trees followed by scarlet oak, black oak, red maple, and white pine. Favored reserve trees include trees with dens, large and long-lived mast-producing trees and long-lived yellow pine. Likely species to leave would include black gum, white oak, hickory, chestnut oak and yellow pine. Thinning would improve species sustainability and promote stand vigor by reducing competition for light, nutrients, and moisture. Through forest health management, environmental assets would be retained over the long term, whereas in the absence of treatment, they could be lost due insect and/or disease outbreaks.

All stands in Table 2k would receive, where needed, pre- and post-harvest site preparation and

timber stand improvement release treatments (also see Appendix C – Herbicide Use Assumptions):

- Pre-harvest Site Preparation: Prior to harvest, midstory species would be treated with an herbicide (Imazapyr and Glyphosate) to reduce post-harvest sprouting of overly-competitive species. Major species targeted for treatment include red maple, white pine and rhododendron between 1 to 7 inches DBH. Treatment would occur 1-3 years prior to harvest, where applicable. Species not treated include dogwood and hard-and soft-mast producing species..
- Post-harvest Site Preparation: Post-harvest site preparation in the stands listed in Table 2k is not required since the objective of the thinning treatment is not promoting natural regeneration. However, if and where site preparation is determined to be needed, residual species between 1 to 7 inches DBH would be mechanically slashed down (chainsaw) and/or treated using herbicides (Imazapyr and Glyphosate) following thinning. Major species targeted for treatment include red maple, white pine and rhododendron. Treatment would occur 1-2 years post harvest, where applicable. Species not treated include dogwood and hard- and soft-mast producing species.
- Timber Stand Improvement (TSI) Release Treatment: The need for TSI release would be determined after Post-harvest Site Preparation. Where needed, two to four years following harvest, overly-competitive sprouts would be treated using herbicides (Triclopyr). This would help to control competition from red maple, yellow poplar and other species.

Shortleaf pine may be underplanted in one or more stands to increase within stand diversity.

5. Maintain Roads and Create Temporary Roads

Approximately 6.3 miles of existing road would be improved and maintained in support of timber sale activities (Table 2l). Improvement/maintenance activities include gravel placement and road grading. Upon completion of the project, 60682 would be closed and seeded, then allowed to return to its previous multi-use trail (2026A) function.

Approximately 1.3 miles of temporary road would be constructed to provide access to treatment stands (Table 2l; App. A, Maps A-3 and A-4). Temporary roads would be closed, stabilized, water barred (where needed), and seeded and fertilized following completion of the timber sale. Where a temporary road is located within or crosses an existing Forest Service trail, the temporary road would be closed and rehabilitated as above, then allowed to return to its previous trail function.

Table 2l: Maintained and Temporary Roads

Road #	Road Name	Miles	Action
316	Bartee Branch	0.60	Pre-Haul Maintenance
316A	Sam's Cove	1.01	Pre-Haul Maintenance
5081	Griffith Branch	4.24	Pre-Haul Maintenance
60682	Furnace Branch	0.47	Pre-Haul Maintenance
Total miles		6.32	
Temporary Road to Comp 69, Stand 17		0.73	Temporary Construction
Temporary Road to Comp 71, Stand 8		0.23	Temporary Construction
Temporary Road to Comp 72, Stand 15		0.35	Temporary Construction
Total miles		1.31	

6. Improve Wildlife Habitat

The following are proposed to improve habitat conditions for terrestrial wildlife (Table 2m):

- Boxes – place roost boxes for bats and nest boxes for birds and small mammals. Two boxes are placed in stands proposed for early successional forest habitat creation.
- Water – construct waterholes, vernal (ephemeral) ponds/pools, or wetlands (~ 1/8th acre) for aquatic insects, amphibians, bats and other wildlife. The type(s) of water resources constructed would vary depending on the current availability of water sources and wildlife needs in the treatment area.
- Logs – provide up to five drumming logs (eight inches or greater in diameter) for ruffed grouse in stands proposed for early successional forest habitat creation.

Table 2m: Terrestrial Wildlife Activities

Location	Boxes (each)	Water (feature)	Logs (each)
Compartment 67	4	1	10
Compartment 68	2	0	5
Compartment 69	4	0	10
Compartment 71	4	1	10
Compartment 72	2	0	5
Compartment 73	2	0	5
Total	18	2	45

7. Prescribed Burn

Conduct low-intensity prescribed burns on approximately 1,057 acres in two burn blocks (Table 2n, App. A, Map A-5). Fire control lines would include existing roads, streams, constructed dozer lines and hand lines. The primary objective of the burns is to promote the health of forest communities. Long-term beneficial effects include maintaining natural communities and stimulating new growth of vegetation that would provide an increase of soft mast and herbaceous plants for wildlife. If post-burn monitoring determines that the burn objectives were not fully met, a follow-up burn or burns would be conducted. Individual burn blocks may be reburned on a two to ten-year rotation.

Table 2n: Prescribed Burns

Burn Name	Acres
Griffith Branch Burn	633
Weaver Branch Burn	424
Total acres	1,057

8. Little Stony Road

Decommission the approximately 5.2 miles of Little Stony Road (FSR 202A) on National Forest System lands, and complete the following proposed activities. See Appendix A, Map A-7 for locations of the following proposed activities:

- Starting at the lower end of 202A, convert the first approximately 2.9 miles to a limited access hiking and fishing trail. The existing bridge would be removed and the associated banks recontoured and stabilized. Water diversions would be installed at each stream crossing (12 total within the 2.9-mile section) to divert surface drainage away from the trail before it approaches the stream. The trail would be rerouted for approximately 500 feet after the second stream crossing to keep it out of a dry section of stream bed. Boulder stepping stones would be installed, where needed, to allow hikers to cross the stream during high flows.
- Beyond the converted trail, two sections of the road (total approximately 0.6 miles) would be obliterated and recontoured. These sections would be graded to their original predevelopment contours, seeded, straw added, and allowed to naturalize.
- An approximately 0.6-mile section of 202A would be obliterated and abandoned. Some portions may be stabilized using standard trail maintenance techniques, otherwise the roadbed would be obliterated through felling of trees and other debris, seeding and straw added for stabilization.
- An approximately 0.8-mile horse/connector trail would be constructed to connect the upper portion of 202A to FSR 60682 (Furnace Branch Rd). The trail would be built to an equestrian trail class level III, and would be suitable for emergency use by fire resources (if necessary).
- The remaining approximately 1.1-mile upper portion of 202A would be maintained as a trail along the ridge of Holston Mountain, and would provide access for emergency use by fire resources (if necessary).
- Wherever present along 202A, illegal structures would be removed and illegal user-created access trails abandoned, obliterated, and recontoured, if necessary.
- Once the work was completed, gates would be installed at both ends of the former road corridor to prevent illegal access, and a small (1/10th of an acre) parking lot constructed at the road's lower terminus.

9. Roads to be authorized

Approximately 8.2 miles of roads would be authorized, per recommendations provided in the Stony Creek Travel Analysis Plan (Table 2o; App A, Map A-6). All OR-7 and OR-8 of the total is to account for powerline access via roads already on the ground. OR-7 is proposed to be added to the system to provide access to the Dip Site Pond for fire emergencies. OR-8 is proposed to be added to the system for power line access and emergency traffic to the Blue Hole recreation site.

Table 2o: Roads to be Authorized

Road #	Proposed FSR Road Name	Proposed FSR#	Miles
OR-1	Horselog Branch	60601	0.47
OR-2	Grindstaff Branch Extension	6059	0.27

Road #	Proposed FSR Road Name	Proposed FSR#	Miles
OR-3	Grindstaff Branch Spur B	6059B	0.28
OR-4	Elliott Hollow Extension	60591	2.46
OR-5	Hurley Branch	60581	2.78
OR-6	Miller Branch Special Use	60701	0.02
OR-7	Hinkle Branch Spur A	60681A	0.39
OR-8	Blue Hole	60721	0.11
OR-9	Fork Ridge	60722	1.27
OR-10	Edwards Tract	60552	0.12
Total Miles			8.17

Design Criteria

Specific actions may be incorporated into the project design during the development of alternatives based on resource concerns and issues raised during scoping and analysis. Design criteria are intended to lessen or eliminate potential impacts from proposed activities. Criteria may or may not be included in RLRMP Standards and Guidelines, or may impose a stricter application of a Standard or Guideline. Design Criteria Common to All Action Alternatives includes:

1. Use broad-based dips or water bars on all access ways on non-level slopes.
2. Use a hydrologist or wildlife biologist to assist in the location of ephemeral pools, springs and seeps.
3. Implement Tennessee Best Management Practices (BMPs) as a minimum to achieve soil and water quality objectives. When RLRMP Standards exceed BMPs, the standards shall take precedence over Tennessee BMPs.
4. Streamside management zones (riparian corridors and filter zones) would be established, as specified in the RLRMP.
5. Any new threatened, endangered, and/or sensitive species locations discovered within a project area may result in all actions being delayed or interrupted within the area. The appropriate district wildlife/fisheries biologist or botanist would be consulted to determine effects of the action on the species.
6. Trees known to have been used as roosts by Indiana bats are protected from cutting and/or modification until they are no longer suitable as roost trees unless necessary for public safety. Consultation with the US Fish and Wildlife Service (FWS) must occur before cutting or modification.
7. Snags with exfoliating bark are not intentionally felled unless necessary for public safety. Exceptions may be made for small-scale projects such as insect/disease control, salvage harvesting, and facility construction.
8. During all silvicultural treatments in hardwood forest types, retention priority is given to the largest available trees that exhibit characteristics favored by roosting Indiana bats.
9. Leave (reserve) areas and exclusions would be established, where necessary to minimize impacts to rare species. All ground-disturbing activities (temporary roads, landings, skid trails, etc.) and timber harvest would be excluded from within the reserve areas.
10. Mixing-water for herbicide use would be brought to the site by work crews and not obtained from streams or other bodies of water.

11. No herbicide would be applied within 30 feet of open water except for selective treatments that use herbicides labeled for aquatic use.
12. Off-road equipment would be cleaned of seeds, soil, vegetative matter and other debris that could hold NNIS seeds and/or propagules. Off-road equipment would be inspected by a Forest Service representative to prevent NNIS introduction or spread in the project areas.
13. Build the fewest skid trails, logging roads, and log landings as feasible.
14. Skid trails would be placed and rehabilitated in a way that limits the spread of existing non-native invasive species from roads, trails, or powerline corridors, into stand interiors. Skid trails and plow lines would be rehabilitated (re-contoured, seeded, etc) after they are no longer needed.
15. Any cultural resource sites found during implementation of the project would be reported immediately to a Forest Service Archaeologist and work would stop in the area.
16. Skid trails and temporary roads for the purpose of timber harvest would not be constructed for sustained distances over 200 feet in areas with slopes of 40% or greater ("steep area"). The 200-foot length can be exceeded however where the skid trail and/or temporary road is needed to traverse a steep area in order to access the remaining harvest unit(s). Trees within the traversed steep area would not be harvested, except where possible through cable winching to equipment placed outside the steep area.
17. Blend the visual impacts of roads and skid trails so they remain subordinate to the existing landscape character in size, form, line, color and texture.
18. Orient openings to blend with the existing landscape characteristics, based on existing vegetation patterns, contours and other natural-appearing features.
19. Shape and feather unit boundaries to avoid straight edges.
20. Retain natural-appearing tree groupings.
21. Minimize the exposure of mineral soils during construction of skid roads and trails, and revegetate cut-and-fill slopes to the extent possible.
22. Screen log landings from view, and restore as close to the original contour as possible.
23. Minimize impacts to existing trails and travelways, and maintain the visual character in the vicinity of trail corridors and travelways.

Comparison of Alternatives

Table 2p provides a comparison of the activities by each alternative. Information provided is focused on activities and quantitative outputs among the alternatives.

Table 2p: Summary Comparison of Alternatives

Proposed Activity	Units	Alt A	Alt B	Alt C
<i>Habitat Diversity / Forest Health</i>				
Shelterwood Regeneration (commercial)	acres	0	351	303
Shelterwood Regeneration (noncommercial)	acres	0	32	32
Crop Tree Release (noncommercial)	acres	0	13	13
Midstory (noncommercial)	acres	0	0	116
Thinning (commercial)	acres	0	0	204
<i>Fire</i>				
Griffith Branch prescribed burn	acres	0	0	633
Weaver Branch prescribed burn	acres	0	0	425

Proposed Activity	Units	Alt A	Alt B	Alt C
<i>Wildlife Habitat Improvement</i>				
Provide, maintain, and monitor wildlife boxes	each	0	18	18
Construct, maintain, and monitor waterholes	each	0	2	5
Provide drumming logs	each	0	45	45
Linear wildlife opening	miles	0	0	0.7
Create spot wildlife opening	acres	0	0	2.0
<i>Recreation</i>				
Construct multi-use/connector trail	miles	0	0	0.8
Install gates	each	0	0	2
Construct parking area	acres	0	0	0.1
<i>Transportation</i>				
Prehaul maintenance	miles	0	6.3	6.3
Temporary road construction	miles	0	1.5	1.3
Decommission FSR 202A (Little Stony Road)	miles	0	0	5.2
FSR 202A (convert to fishing/hiking trail)	miles	0	0	2.9
FSR 202A (obliterate and recontour)	miles	0	0	0.6
FSR 202A (obliterate and abandon)	miles	0	0	0.6
FSR 202A (maintain as foot path and for access)	miles	0	0	1.1
Authorize roads	miles	0	8.2	8.2

Chapter 3: Affected Environment and Environmental Consequences

This section summarizes the physical, biological, social and economic environments of the affected project area and the potential changes to those environments due to implementation of the alternatives. It also presents the scientific and analytical basis for comparison of the alternatives.

Soil and Water Resources

Affected Environment

The Stony Creek project area is located on the southeast side of Holston Mountain, approximately five to nine miles northeast of Elizabethton, Tennessee.

The majority of the project area is situated in the Blue Ridge physiographic province and the Southern Sedimentary Ridges Ecoregion (66e) (TDEC 2000). The remainder of the project area, namely the valley bottom, is located in the Limestone Valleys and Coves Ecoregion (66f) with a small sliver of Southern Limestone/Dolomite Valleys with Low Rolling Hills (67f). The Blue Ridge physiographic province characteristically exhibits steep mountain terrain in headwater areas where much of the planned management activities for the Stony Creek project would occur. The rocks are primarily Cambrian-age sedimentary (shale, sandstone, siltstone, quartzite, conglomerate). The majority of stands proposed for treatment in both Alternatives are underlain by the Erwin Formation (Ce), with a few of the lower elevation stands (Alts B and C; 71/1, 71/8, 71/29. Alt C only: 68/12, 68/28, 69/11, 69/12, 69/14, 69/15, 69/17, 69/35, 69/37) including areas underlain by the Shady Dolomite (Cs). Lower stream reaches (down gradient of the project area) occur on limestone. Table 3a shows dominant Geologic formations in the project area.

Table 3a: Stony Creek project area Geology

Geologic Map Symbol	Geologic age	Formation	Rock Type	Description
Cs	Cambrian	Shady Dolomite	Dolomite, Limestone	Light-gray, well-bedded dolomite with thin- to medium-bedded gray limestone; yellowish-brown residual clays with “jasperoid” diagnostic. Thickness about 1,000 feet.
Ce	Cambrian	Erwin	Quartzite, Shale, Siltstone, Sandstone	White, vitreous quartzite, massive, with interbeds of dark-green silty and sandy shale, minor siltstone, and very fine-grained sandstone. Thickness 1,000 to 1,500 feet.

Elevations range from 4100 feet on top of Holston Mountain to 1900 feet along Pierce Branch. Soils are predominantly friable loams and fine sandy loams with variable amounts of sandstone rock fragments. Natural vegetation is mostly mixed oak and oak-pine forests.

Average annual temperature is 52 degrees Fahrenheit. January is generally the coldest month with an average temperature of 34 degrees Fahrenheit. July is typically the hottest month, averaging 70 degrees Fahrenheit. Precipitation averages 48 inches a year with the highest average (5.51 inches) occurring in July. The least rainfall (2.53 inches average) occurs in October. The growing season is estimated to be 180 days, with prevailing winds predominantly from the southwest (NRCS 2013a).

Soils

Affected Environment

The soils within stands proposed for commercial timber harvest are primarily loam-based (e.g., loam, sandy loam, silt loam), are deep and well drained, allow good nutrient uptake, and promote rapid regeneration. Additional information and data regarding soils in the project area and in stands proposed for commercial timber harvest can be found in Appendix F.

Scope of Analysis

The scope of the analysis for direct and indirect effects to soils is primarily the stands proposed for commercial timber harvest, including timber harvest-related road maintenance and temporary road construction, and the proposed road authorizations. Other ground disturbing actions, such as the proposed prescribed burning, wildlife improvements, road decommissioning, etc. are considered as part of the analysis as well. Cumulative effects will include private lands within the compartments where the actions would occur. The time period for the analysis is the past 10 years since research demonstrates that the majority of direct and indirect effects on soils recover to baseline or near-baseline levels within this timeframe. The cumulative effects analysis will also consider future activities in the next five years since this timeframe coincides roughly with USFS out-year planning.

Effects Analysis of the Alternatives

Alternative A (No Action)

Direct and Indirect Effects

Under the No Action Alternative natural processes of soil weathering, and soil accumulation and erosion would continue. There would be no direct effects on soils given that the proposed management activities would not be implemented. However, under this alternative, opportunities to correct or improve Forest Service system roads and/or road drainage problems (typically concomitant with timber harvesting) that can lead to erosion and increased sedimentation would be missed. Standard scheduled road maintenance would continue, and may result in some soil disturbance. Maintenance activities, however, typically result in minimal soil loss and sedimentation potential.

Cumulative Effects

Alternative A would have no direct cumulative effects on soil resources within the cumulative effects analysis area since the proposed actions would not be implemented. Although current Forest Service road maintenance would continue under this alternative, the alternative would have an indirect cumulative effect when considered with reduced system road improvements in the future, and current soil erosion/sedimentation problems associated with county and private roads.

Alternative B (Proposed Action)

Direct and Indirect Effects

Timber Harvesting

Alternative B proposes to create 351 acres of early successional forest habitat through commercial timber harvest. One stand (71/29) is proposed for noncommercial regeneration. No soil erosion or compaction would occur as a result of noncommercial treatment. The logging method (tractor skidding) associated with commercial timber harvest has the potential to affect soils by creating skid trails and ruts where felled timber is cabled to a landing. This can result in soil compaction, erosion, soil disturbance, reduced infiltration rates, nutrient reduction, reduced soil productivity, and increased sediment production. However, research has shown that the application of Best Management Practices (BMPs) substantially reduces the impacts to physical resources (Anderson and Lockaby 2011). For example, Tennessee BMPs (TDA, Division of Forestry 2003) for forest management include practices for locating, constructing, and retiring forest (temporary) roads, provisions for proper drainage and erosion control measures, location and stabilization of log landings, location and design of skid trails, etc. This is not to say that soil compaction, erosion, etc., would not occur with the application of BMPs, but that any impacts would be greatly reduced.

Research (Dissmeyer and Stump 1978; Miller et al. 1986a), local experience, and field verification has shown that effects of timber harvest and associated site preparation on soil erosion rates are identifiable for up to three years, post-treatment. Timeframes for recovery of soil compaction and topsoil displacement vary, and are based on soil type, slope, aspect, and other factors. Based on the acres of proposed harvest, soil compaction and topsoil displacement would affect approximately 1.3% of the Stony Creek Watershed (383 acres of proposed harvest/29,089 total acres of FS lands within the watershed). This meets Forest-wide Goal 8 which states that “[d]uring mechanical disturbance on all soils dedicated to growing forest vegetation, the organic layers, topsoil and root mat will be left in place over 85 percent of a project area” (USDA, Forest Service, 2004a, p. 24). While the areas covered by skid trails, landings and temporary roads would be directly affected, the limited spatial extent of those effects would result in negligible effects to the soil health of the watershed as a whole. While the Stony Creek Watershed is likely to be revisited for potential vegetation management within the next 10-15 years, any timber harvest proposed would not occur in the current project’s proposed treatment areas.

The potential for surface erosion is also directly related to the amount of bare, compacted soil exposed to rainfall and runoff (Reid and Dunne 1984). In Alternative B, as well as other proposed action alternatives, bare and compacted soil is related to roads, trails, and landings. See *Roads* below for discussion of road impacts. In short, Tennessee State Best Management Practices and Forest Service Standards and Guidelines (USDA Forest Service 2004a) would be followed, as a minimum, to address soil concerns regarding road maintenance, temporary road construction and closure and landing placement and construction. Where Forest Service standards exceed BMPs, those standards shall take precedence.

The proposed crop tree release treatments in the project area would have little to no potential to affect soil resources since this treatment would use mechanical means (e.g. chainsaw) to accomplish the objective which does not require the use of heavy equipment such as skidders.

Roads

Many of the roads on Forest Service land in the project area are presently closed. Under this alternative, the proposed pre-haul road maintenance would result in some soil erosion and sedimentation. However, the action would also provide the opportunity to correct or improve approximately 6.3 miles of Forest Service system roads, thus reducing or eliminating problems that can lead to erosion and increased sedimentation.

There would be a potential for soil erosion, compaction, reduced infiltration rate, and sediment production from the proposed 1.5 miles of temporary road construction. Measures designed to stabilize the road surface during construction, such as adding aggregate surfacing, and the placement of water control measures, such as installing water diversion devices, would greatly reduce adverse effects. All temporary roads would be closed and stabilized post-harvest. Again, Tennessee State BMPs and Cherokee National Forest Standards would be applied during and after temporary road construction to reduce any impacts.

Approximately 8.2 miles of road would be authorized. These roads are currently in place, and were considered necessary, per the Stony Creek Travel Analysis Report, for resource management and/or public access. The roads would receive periodic maintenance to prevent/correct drainage or erosion problems, as needed.

Herbicides

Under Alternative B, Imazapyr, Glyphosate and Triclopyr would be used for both pre- and post-harvest site treatments in all stands proposed for timber harvest (383 acres). Minimal amounts of chemical would come in contact with the soil as most are applied on the leaf surface or directed into the vegetation. (See Appendix C–Herbicide Use Assumptions for amount of herbicide to be used.)

Glyphosate (Roundup) would have minimal to no impacts on soil resources. The herbicide is highly adsorbed by and tightly bound in most soils especially those with high organic content. This results in little transference of the herbicide by rain or other water sources from the point of soil contact. The herbicide is readily metabolized by soil bacteria. Many species of microorganisms can use glyphosate as a carbon source.

Imazapyr is the common name for the active ingredient in herbicide products, Arsenal and Chopper. The herbicide is applied to foliage, freshly cut stumps, or applied to cuts made around the base of a tree. EPA categorizes Imazapyr as one of the least toxic herbicides and it is water-soluble. Since it does not bind to organic material in the soils (Malipudi et al. 1991), the impacts to soils would be negligible, if at all.

Triclopyr ester (Garlon 4), also a common herbicide used in forestry applications, poses a slightly greater risk to fish and invertebrates than the other two herbicides. However, the methods of application (foliar treatments and/or direct injection) and compliance with Forestwide Standards would minimize herbicide contact with the soil or surface water.

Herbicide applications to control competing vegetation do not disturb the topsoil layer, do not create additional bare soil, and do not adversely affect watershed condition when used responsibly (Neary and Michael 1996). By utilizing herbicides as opposed to mechanical pre- and post-preparation methods, the organic matter is left in place, and off-site soil movement does not

increase the loss of nutrients following harvest activities. Maxwell and Neary (1991) concluded that the impact of vegetation management techniques on erosion and sediment losses occurs in this order, herbicides < fire < mechanical.

Wildlife Activities

Projects to improve habitat conditions for wildlife include the placement of boxes for bats, birds and small mammals, and the creation of ruffed grouse drumming logs. The construction of two waterholes would result in some minor soil disturbance; however, any changes in soil characteristics would be negligible given the small areas involved and locations on level terrain. Direct effects would be the removal of surface soil to create the waterholes; however, the exposed mineral soil would revegetate over time.

Cumulative Effects

The Stony Creek project should not result in unacceptable cumulative effects to the soils resource. The proposed timber harvesting would have no cumulative effects since there has been no timber harvesting within the Stony Creek project area in the last 10 years. Soils within the project area from past timber harvest (i.e., timber harvest conducted > 10-years ago) have recovered, are stable and show no signs of chronic soil erosion or instability. There are currently no long-term plans for vegetation management beyond the Stony Creek project.

Scheduled road maintenance (i.e. road maintenance not associated with timber harvest) within the cumulative effects analysis boundary, where surfaces are bladed or ditches cleaned, can result in soil erosion and sedimentation. Combined with the proposed pre-haul maintenance, these activities could result, depending on soil type, slope, etc, in short-term adverse cumulative effects. However, drainage structures are typically repaired and road drainage improvements made, where needed, during scheduled road maintenance, which, when combined with similar activities associated with pre-haul road maintenance, would result in a beneficial cumulative impact to overall watershed health.

Other proposed activities for wildlife improvement and herbicide use would have no cumulative effect to the soil resource. This is based on the low impact of the planned activities and the limited area that may be impacted.

Activities on private land within the cumulative effects boundary would be expected to continue in the future. These activities, as described in the no action alternative, are typical community activities that involve road construction, structures, pastures, stream crossings, timber harvesting, and farming. These activities would continue to impact soil resources and, depending on scope, location and timing, would add, cumulatively, to any impacts from Alternative B.

Alternative C

Direct and Indirect Effects

Timber Harvesting

Alternative C proposes to treat 507 acres (303 acres of early successional – 10 stands, and 204 acres of thinning – six stands) utilizing commercial timber harvest vs. 351 acres (all early successional) on 10 stands in Alternative B. Both alternatives would create 32 acres of early

successional forest through noncommercial means. Potential impacts to soils from timber harvesting in Alternative C would be the same as those for Alternative B.

Although a larger area would be treated under Alternative C, Forest-wide Goal 8 regarding limiting mechanical disturbance of soils in forested areas would still be met (see USDA, Forest Service, 2004a, p. 24) since the additional acres would increase the amount of affected area within the watershed by 0.4% for a total of 1.7%. The RLRMP Standards and Guides and Tennessee BMPs designed to minimize long-term impacts to soil resources, as mentioned in Alternative B, would also apply to this alternative.

The potential effects of the midstory treatments are discussed in the *Herbicides* section below.

Roads and Trails

Alternative C proposes the same pre-haul road maintenance as Alternative B and 0.2 miles less temporary road construction. The reduction in temporary road mileage would result in slightly less topsoil disturbance and soil compaction than Alternative B, but otherwise the direct and indirect effects of Alternative C would be similar to those described in Alternative B.

Alternative C proposes to decommission approximately 5.2 miles of Little Stony Road (FSR 202A) on National Forest System lands. This action was proposed with the specific objective of improving the condition of soil and water resources in the project area. Decommissioning the road would eliminate OHV use of the road, the current source of chronic soil disturbance, compaction, sedimentation into Little Stony Creek, and potential hydrocarbon contamination. It would also remove the potential for new areas of soil disturbance to occur in the form of user-created trails.

Note: See Chapter 2, Alternative C, action #8: Little Stony Road, pages 27-28 for a full list and description of the proposed activities being analyzed below. All activities involving ground/soil disturbance would follow RLRMP Standards and Guides and BMPs.

Activities associated with converting approximately 2.9 miles of the road to a hiking trail would result in soil disturbance; however, these activities would lead to significantly less disturbance than the current OHV use over the long term. Allowing the footprint of the road/trail to revegetate would remove a source of sedimentation into Little Stony Creek. Use of the trail would, in time, cause localized soil compaction. When placed in the larger context of the watershed, this would result in minor effects to the soil resource.

Approximately 1.2 miles of the existing roadbed would be obliterated and rehabilitated. Equipment used to grade and recontour the slopes would result in soil disturbance, erosion, and sediment movement into Little Stony Creek. The use of RLMRP Standards and Guides and BMPs, however, would reduce the impacts. Completing drainage repairs and recontouring selected areas of the road would allow topsoil to redevelop and support healthy vegetative communities and associated ecosystems over time. All recontoured sections of the road would be stabilized, seeded, then allowed to naturalize.

Constructing a 0.8-mile multi-use/connector trail and 0.1-acre parking area would also result in some soil disturbance. RLRMP Standards and Guides and BMPs would again be followed during all phases of construction thereby reducing or eliminating impacts to soils. The removal of illegal

structures would allow the eventual recovery of additional areas of compacted, bare mineral soil.

Herbicides

Under Alternative C, Imazapyr, Glyphosate and Triclopyr would be used for both pre- and post-harvest site treatments in all stands proposed for timber harvest (541 total acres). Imazapyr and Glyphosate would be used in stands proposed for midstory treatments (116 acres). Minimal amounts of chemical would come in contact with the soil as most are applied on the leaf surface or directed into the vegetation. (See Appendix C – Herbicide Use Assumptions for amount of herbicide to be used.) Potential effects associated with the use of these herbicides would be the same as those described in Alternative B. As in Alternative B, the impacts to soils would be negligible, if at all.

Wildlife Activities

In addition those proposed in Alternative B, wildlife activities proposed in Alternative C would include the following:

- Construction of three additional water features (for a total of five);
- Conversion of the temporary road accessing compartment 69, stand 17 to a 0.7-mile linear wildlife opening upon completion of timber harvest activities; and
- Conversion of the proposed log landing in compartment 69, stand 17 to a 2.0-acre spot wildlife opening.

The conversion of temporary roads and log landings to wildlife openings under Alternative C would have the same stabilizing effects as the revegetation called for by standard BMP implementation under Alternative B. The construction of three additional waterholes would result in a minor increase in the amount of soil disturbance; however, any changes in soil characteristics would be negligible given the small areas involved and locations on level terrain. Direct and indirect effects would be the same as Alternative B.

Prescribed Burn

Approximately 1,057 acres (two blocks) of prescribed burning are proposed in this alternative. Fire generally affects soil erodibility if mineral soil is exposed. Other than dozer or handline, there would be little, if any, mineral soil exposure resulting from the low intensity burns. Reports show little to no erosion after light to moderate intensity fires in the southeastern United States (Swift et al. 1993). However, burns conducted in areas with previous soil disturbance, such as where skidding of logs has occurred, increases the probability of soil erosion after burning (ibid).

Effects to the organic layers and soil organisms from burning depends greatly on heat penetration into the soil. Heat penetration depends upon duration of heating and soil moisture (ibid). Where only surface material is burned, the duration of heating would tend to be very low due to its rapid consumption. However, the burn would result in mortality to organisms, such as nematodes, springtails, insect larvae, mollusks (snails and slugs), mites, woodlice, and millipedes, and fungi, found in this layer. Where larger fuels, such as dead and down logs and limbs, occurred within the burn area, the potential for higher heat duration could also result in mortality of organisms, including vertebrates such as salamanders, small mammals, etc. However, soil moisture tends to be higher beneath larger fuels which may offer some measure of protection to these organisms.

The types of burning employed by the Forest Service limit the effects to the soil resource by burning under prescription when the duff and humus soil layers can be protected. By burning within strict parameters and lighting ridges and upper slopes, the fire burns dryer sites and extinguishes in the moist streamside and bottomland areas.

Prescribed burns use existing roads and natural barriers (riparian areas, creeks, streams and rivers) as fire lines, wherever possible. Constructed firelines, either by dozer or by hand, would include placing drainage features such as dips, lead-outs, or reverse grades at regular intervals within the fireline, where needed, to reduce concentrated water flow, erosion, and sediment. Nonetheless, the construction of firelines would displace topsoil and reduce soil productivity where they occur. Existing firelines generally need to be re-bladed prior to burning or otherwise treated during subsequent burning activities, which would increase soil displacement. Hand lines would result in less soil impacts since there would be less soil disturbance. Any impacts to soils, including soil productivity, would be short term since all firelines would be seeded following completion of the burn, in accordance with Forestwide Standard FW-88 (USDA Forest Service 2004a, p. 53).

Cumulative Effects

With the exception of the decommissioning Little Stony Road (FR 202A) and associated activities, the cumulative effects from Alternative C on soil resources would be similar to those discussed under Alternative B with the following additions.

The Rye Patch Knob prescribed burn (2,613 acres) was last conducted in 2005. The 1,057 acres of prescribed burns proposed in Alternative C would be cumulative with this burn. However, any cumulative effects would be negligible since: 1) areas of previous soil disturbance such as skidding trails and firelines associated with the Rye Patch Knob burn would have healed since the burn was conducted, 2) the organic layer and populations of organisms within the Rye Patch Knob burn area would have recovered since the burn was conducted, and 3) fireline construction employs erosion control measures such as relatively permanent drainage dips, reverse grades, out-sloping and lead-off ditches along with other erosion control measures.

Road decommissioning and rehabilitation, when considered with past, present and reasonably foreseeable scheduled road maintenance and the proposed pre-haul maintenance, should improve the overall condition of the soil resource in the cumulative effects analysis area, a beneficial cumulative effect.

Effects of the temporary road construction and multi-use trail construction would include soil erosion. However, with the application of Forest Service Standards and Guides and BMPs, the cumulative effects would be minimized.

The road decommissioning et al would have a beneficial cumulative effect when considered with the pre-haul maintenance activities by improving the overall condition of the soil resource in the analysis area.

Activities on private land within the cumulative effects boundary would be expected to continue in the future. These activities, as described in the no action alternative, are typical community activities that involve road construction, structures, pastures, stream crossings, timber harvesting,

and farming. These activities would continue to impact soil resources and, depending on scope, location and timing, would add, cumulatively, to any impacts from Alternative C.

Water

Affected Environment

Stands proposed for harvest are all in the Stony Creek 6th level Watershed (Hydrologic Unit Code: 060101030501), which is part of the Watauga River, a 5th level Watershed (0601010305). The landforms of the area are generally characterized by steep, dissected mountains and narrow V-shaped valleys. Streams common to this landform are characterized by Rosgen (2012) as “A” and “B” types: generally high energy, but stable with a low sediment supply due to their “bouldery” composition. “C” type streams (Rosgen 1996) occur where valley bottoms are wider due to the deposition of alluvial materials over time. The project area has a trellis drainage pattern. Table 3b presents the designated uses of waterbodies in or immediately downstream from the analysis area (from TDEC 2007a).

Table 3b: Use Classifications for Surface Waters

Stream	Description	DOM	IWS	FAL	LWW	IRR	NAV	TS	NRTS
Watauga River	25.8 to 55.1 (N.C.-TN Line)	X	X	X	X	X			X
Stony Creek	0.0 to Origin			X	X	X			X
Little Stony Creek	0.0 to Origin			X	X	X			X
Pierce Branch	0.0 to Origin			X	X	X		X	
Bartree Branch	0.0 to Origin			X	X	X		X	
Mill Creek	0.0 to Origin			X	X	X			X
No. Fork Stony Crk	0.0 to Origin			X	X	X			X
Upper Hinkle Branch	0.0 to Origin			X	X	X		X	

DOM - Domestic Water Supply

IRR - Irrigation

IWS - Industrial Water Supply

NAV - Navigation

FAL - Fish and Aquatic Life

TS - Trout Stream

REC - Recreation

NRTS - Naturally Reproducing Trout Stream

LWW - Livestock Watering and Wildlife

All waters within the Cherokee National Forest are classified as Exceptional Tennessee Waters (TDEC 2007b), consequently no degradation that threatens the designated uses of these waters is permitted. The TDEC Stream/Waterbody Assessments revealed that Stony Creek is supporting its designated uses (TDEC 2013); however, none of the tributary streams were evaluated.

It should be noted that Little Stony Creek was initially evaluated as a potential reference stream for the Southern Sedimentary Ridges Ecoregion (66e), but was eliminated from consideration due to impacts from Forest Service Road 202A that runs up the drainage and the densely populated residential/agricultural area along the lower portion of the creek. Little Stony Creek is heavily impacted by illegal OHV use. Over the past decade, brook trout populations in Little Stony Creek have declined (M. Carter, CNF, North Zone Aquatic Biologist, pers. comm., May 21, 2012).

The Stony Creek analysis area includes 11 subwatersheds (Table 3c). These range in size from 219

acres (Pierce Branch) to 1,785 acres (Little Stony Creek). Forest Service ownership is predominantly in the upper half of affected watersheds, ranging from 52 to 96 percent of ownership as shown in Table 3c. There are no known water quality data for these watersheds but, with the exception of Little Stony Creek, water quality on National Forest System land is generally good as a result of forest cover, maintenance of system roads, and, where past management activities have occurred, the implementation of Forestwide Standards and Goals (Cherokee National Forest 2004c) and Tennessee Best Management Practices.

Table 3c: Forest Service Ownership by Subwatershed

Subwatershed	Total Acres	FS Acres	%FS
Bartee Branch	379	327	86%
Furnace Branch	1017	976	96%
Griffith Branch	290	259	90%
Hinkle Branch	765	708	93%
Laurel Branch	901	746	83%
Little Marklin Branch	424	219	52%
Little Stony Creek	1,786	1,689	95%
Mill Creek	1,438	1,275	89%
Pierce Branch	219	189	86%
Sam's Cove	238	155	65%
Weaver Branch	659	304	46%
Totals	8,116	6,847	84%

Scope of Analysis

Unless otherwise stated, the scope of analysis for effects to Water Resources are National Forest System lands in the 11 subwatersheds (a.k.a. the project area) shown in Table 3c. Cumulative effects analysis includes private lands within the above subwatersheds. The cumulative effects analysis will consider activities that have occurred in the past 10 years since sediment delivered to the stream should work its way through the system within this timeframe. The cumulative effects analysis will also consider future activities in the next five years since this timeframe coincides roughly with USFS out-year planning.

Effects Analysis of the Alternatives

Alternative A (No Action)

Direct and Indirect Effects

On National Forest System lands, standard road maintenance and other activities such as recreation would continue. Rainfall events and natural erosion processes would continue to influence stream systems within the project area. The No Action Alternative would have no direct effects to stream systems since the proposed management activities would not occur at this time. Timber management, however, often provides a means to improve roads, stream crossings, and drainage systems. Under this alternative opportunities may be missed to correct or reduce problems that can lead to increased sedimentation in streams.

Cumulative Effects

Alternative A would have no direct cumulative effects on water resources within the cumulative effects analysis area since the proposed actions would not be implemented. Although current Forest Service road maintenance would continue under this alternative, the alternative would have an indirect cumulative effect associated with reduced system road improvements anticipated in the future, and current soil erosion/sedimentation problems on county and private roads.

Alternative B (Proposed Action)

Direct and Indirect Effects

Timber Harvesting

Alternative B proposes commercial timber harvest on 351 acres (10 stands). One stand—compartment 71, stand 29 (32 acres)—would be regenerated noncommercially. Table 3d shows the proposed harvest stands within each subwatershed. Note that some stands are shared between subwatersheds. The table reflects the portion of the shared stands, where appropriate, within the individual subwatersheds. Neither crop tree release nor midstory treatments are included in the table below.

Table 3d: Alternative B Proposed Timber Harvest by Subwatershed

Subwatershed (SWS)	Total SWS Acres	Harvest within SWS (acres)	% of SWS Affected	Harvest within SWS (compartment/stand)
Bartee Branch	379	44	8%	71/29 ^(a)
Furnace Branch	1017	80	8%	66/40, 67/18, 68/5, 68/30
Griffith Branch	290	45	15%	67/2, 67/18
Hinkle Branch	765	0	0%	
Laurel Branch	901	26	3%	71/1, 71/8, 72/15
Little Marklin Branch	424	26	6%	73/17
Little Stony Creek	1786	38	2%	66/40, 68/30
Mill Creek	1438	55	4%	72/15, 73/17
Pierce Branch	219	34	16%	67/2, 67/7
Sam's Cove	238	35	15%	71/1, 71/8
Indian Creek-South Fork Holston River ^(b)	31,581	1	0.003%	66/40
Totals^(c)	7457	383	5%	

(a) Noncommercial harvest.

(b) A small portion of stand 66/40 is not located in the Stony Creek 6th Level Watershed, but is in the Indian Creek-South Fork Holston River Watershed (HUC12: 060101020602).

(c) Totals are only for the Stony Creek Watershed. Values do not include the portion of stand 66/40 in the Indian Creek-South Fork Holston River Watershed.

There is always a risk of sedimentation of streams and riparian areas from activities associated with commercially harvested stands (indirect effect). Noncommercially harvested stands have a low risk of increasing sedimentation since commercial harvest-associated equipment (e.g.

skidders) would not be used; skid trails, landings, etc would not be present; and temporary road(s) would not be needed to access the stand(s). Research (Anderson and Lockaby 2011), experience, and field verification confirm that Best Management Practices are effective in preventing this sedimentation. Tennessee BMPs and RLRMP Standards would be implemented for all timber harvest associated activities. In addition, all streams and riparian areas adjacent to the proposed harvest treatments would be buffered according to standards in the RLRMP (USDA Forest Service 2004a). Vegetation within the buffer zone would help trap any sediment before it reached the stream(s), thereby decreasing sedimentation.

Other vegetation management, i.e. the proposed mechanical crop tree release, would have no effect on streams or riparian areas. No ground disturbance from logging equipment would occur in these stands, and the aforementioned RLRMP buffers and BMPs would be implemented. Given the limited amount of the total watershed area affected (5%; Table 3d), little to no effects on stream flow or water yield should occur. Buffering the streams (per the RLRMP) would ensure that stream temperatures would not be affected.

Research has also shown that impacts of timber harvesting on sediment yield are directly related to skid trail layout and road building, as well as maintenance activities on access roads used for removing timber. When roads and skid trails are properly constructed and maintained there is generally minimal impact on stream sedimentation (Anderson and Lockaby 2011). See *Roads* below for discussion of road impacts.

Herbicides

Under Alternative B, Glyphosate, Imazapyr, and Triclopyr would be applied manually in all stands proposed for timber harvest (383 acres) for both pre- and post-harvest site treatments. (See Appendix C for information regarding amounts proposed to be used for the three herbicides.) Overall, the action would have negligible effects on water resources. Unless otherwise specified, the following information is from Syracuse Environmental Research Associates (SERA) Risk Reports for the specific herbicide used:

Glyphosate (Roundup) would have negligible to no impacts on water resources. The herbicide is highly adsorbed by and tightly bound in most soils especially those with high organic content. This results in little transference of the herbicide by rain or other water sources from the point of soil contact. The herbicide is readily metabolized by soil bacteria, and when present in water by aquatic microorganisms. Many species of microorganisms can use glyphosate as a carbon source.

Imazapyr is the common name for the active ingredient in herbicide products Arsenal and Chopper. The herbicide is applied applied to foliage, freshly cut stumps, or applied to cuts made around the base of a tree. EPA categorizes Imazapyr as one of the least toxic herbicides and it is water-soluble (Mallipudi et al. 1991).

Triclopyr ester (Garlon 4), also a common herbicide used in forestry applications, poses a slightly greater risk to fish and invertebrates than the other two herbicides. However, in a review of studies looking at the stream flow fate of triclopyr, the highest stream water concentrations of the herbicide are found where buffer strips are not utilized. When buffer strips are employed, peak concentrations of this chemical have not been found to exceed action levels. Compliance with Forestwide Standards for herbicides would minimize herbicide effects on surface water

Where buffer strips are used or other mitigation techniques are employed, forestry herbicides generally do not pose a threat to water quality. The small quantity of herbicide used and the application method and strict handling standards when combined with streamside management zones should insure that no measurable direct or indirect effects would occur from the 383 total acres proposed to be treated in the project area.

Roads

Although road systems are the chief cause and contributor of sediment to streams in a forested environment there should be no measureable impacts to any of the stream systems from the road activities proposed in Alternative B. While some soil erosion, compaction, and sediment production from the proposed 1.49 miles of temporary roads would occur, measures designed to stabilize the road surface during construction, such as adding aggregate surfacing, installing water diversion devices, and the application of other Tennessee BMPs and RLRMP Standards to control erosion and potential sedimentation would reduce any impacts to stream systems.

Other potential risks and sources of sedimentation come from stream crossings. Again, BMPs have been shown to be effective in preventing sedimentation at stream crossings (Reidel et. al. 2004). Only the temporary road accessing Compartment 68 Stand 5 would cross a perennial stream. Approximately 8.2 miles of road would be authorized and included in the forest road system. These roads are currently in place, and would receive maintenance to prevent/correct drainage or erosion problems, as needed. Where steep mountain streams occur, pre-haul maintenance and the adoption of BMPs can facilitate stream restoration, e.g. the reduction of road sediment yield would allow streams to flush themselves of previously deposited road sand and fine gravel (Reidel et. al 2004). Log landings, typically located on roads (or ridge tops), would not be located near streams or riparian areas and would not generate any direct or indirect effects.

Wildlife Activities

Direct and indirect effects to water resources from the proposed wildlife improvement activities would be similar to those described in the Alternative B soils analysis. Effects from the construction of two water holes would be the capture and retention of water in the localized area; however, any impacts would be negligible given the small areas involved and their locations on level terrain.

Cumulative Effects

The Stony Creek project would not result in any measurable cumulative effects to streams or riparian areas. Cumulative effects to streams and riparian areas on National Forest System lands can occur from past timber harvesting, and roads, recreation (trails, illegal OHV use) or other management activities that cause ground disturbance. However, no commercial timber harvesting has occurred within the Stony Creek project area in the last 10 years. Additionally, with the exception of access roads and landings, watersheds typically recover within 2-5 years post-harvest, when management activities are properly designed and appropriate design criteria are implemented. Other proposed activities, e.g. wildlife improvement, road decommissioning, and herbicide use should have no unacceptable cumulative effects to water resources.

Activities on private land beyond the forest service boundary would be expected to continue in the future. These activities, as described in the no action alternative, are typical community activities

that involve road construction, structures, pastures, stream crossings, farming and timber harvesting. These activities would continue to impact water resources and add, cumulatively, to any impacts from Alternative B.

Alternative C

Direct and Indirect Effects

Timber Harvesting

Alternative C proposes to treat 507 acres (303 acres of early successional – 10 stands, and 204 acres of thinning – six stands) utilizing commercial timber harvest vs. 351 acres (all early successional) on 10 stands in Alternative B. Both alternatives would create 32 acres of early successional forest through noncommercial means. Although there would be a slightly higher potential for accelerated sediment delivery as compared to Alternative B, potential impacts from timber harvesting in Alternative C would be the same as those for Alternative B.

Table 3e shows the proposed early successional forest and thinning within each subwatershed. Note that some stands are shared between subwatersheds. The table reflects the portion of the shared stands, where appropriate, within the individual subwatersheds. Total acres are higher than proposed due to rounding. Neither crop tree release nor midstory treatments are included in the table below.

Table 3e: Alternative C Proposed Timber Harvest by Subwatershed

Subwatershed (SWS)	Total SWS Acres	Harvest within SWS (acres)	% of SWS Affected	Harvest within SWS (compartment/stand)
Bartee Branch	379	44	12%	71/8, 71/29 ^(a)
Furnace Branch	1,017	29	3%	67/18, 68/12, 68/28, 69/15, 69/17, 69/35
Griffith Branch	290	45	15%	67/2, 667/18
Hinkle Branch	765	40	5%	69/12, 69/14, 69/17, 69/37
Laurel Branch	901	26	3%	71/1, 71/8, 71/15
Little Marklin Branch	424	26	6%	73/17
Mill Creek	1,438	55	4%	72/15, 73/17
Pierce Branch	219	34	16%	67/2, 67/7
Sam's Cove	238	35	15%	71/1, 71/8
Weaver Branch	659	206	31%	68/12, 68/28, 69/11, 69/12, 69/14, 69/15, 69/17, 69/35, 69/37
Totals	6,330	540	8%	

(a) Noncommercial harvest

The proposed mechanical crop tree release would have no effect on sediment delivery. Potential effects of proposed midstory treatments are discussed in the *Herbicides* section below.

Herbicides

Under Alternative C, Imazapyr, Glyphosate and Triclopyr would be used for both pre- and post-harvest site treatments in all stands proposed for timber harvest (541 acres). Imazapyr and Glyphosate would be used in stands proposed for midstory treatments (116 acres). See Appendix C – Herbicide Use Assumptions for amount of herbicide to be used. Methods of application and compliance with BMPs and Forestwide standards would ensure that minimal amounts of chemical would migrate to surface water. Consequently, despite a larger treatment area and application of larger quantities of chemicals used, potential effects associated with the use of these herbicides in Alternative C would be the same as Alternative B. As in Alternative B, the impacts to water resources would be negligible, if at all.

Roads and Trails

Alternative C calls for the same road maintenance as Alternative B and 0.2 miles less temporary road construction. This reduction in road mileage would result in slightly less potential for accelerated sediment delivery than Alternative B. It is to be noted that none of the proposed temporary roads in Alternative C cross perennial streams (as compared to one in Alternative B.) Thus, direct and indirect effects of temporary road construction would be slightly less than those of Alternative B.

Alternative C proposes to decommission approximately 5.2 miles of Little Stony Road (FSR 202A) found on National Forest System lands. See Chapter 2, Alternative C, action #8: Little Stony Road, pages 27-28 for the full list and descriptions of the proposed activities. This action was proposed with the specific intent of improving the condition of soil and water resources in the project area. Specifically, this action is intended to:

1. Reduce sediment delivery to Little Stony Creek resulting from illegal OHV use thereby removing the source of the stream's impairment and restoring habitat for the declining brook trout population; and
2. Restore the hydrology and drainage density of the subwatershed to a more natural condition by installing appropriate drainage features or recontouring the road prism in areas where the road has captured either a stream or overland flow.

Methods used to rehabilitate the road may result in a short term increase in sediment delivery associated with soil disturbance, however long term sediment delivery rates would decrease. Discontinuation of OHV use on the road would remove the existing source of chronic sedimentation and potential hydrocarbon contamination of water resources in the area. The removal of OHVs in combination with implementation of drainage repairs and recontouring of select areas would move the hydrology of the riparian area towards a more natural state. It would also remove the potential for new areas of hydrologic disturbance to occur in the form of user-created trails on land and in the stream itself.

Removal of illegal structures would allow recovery of additional areas of compacted bare mineral soil, thereby restoring riparian function and removing additional sources of sediment.

Use of the properly stabilized and selectively relocated lower portions of the road as a hiking trail would result in significantly less sediment delivery and hydrologic alteration than the current OHV

use. Use of the properly stabilized upper portion of the road as a horse trail would also improve hydrologic condition and reduce sediment delivery rates.

Construction of a 0.8-mile multi-use/connector trail would result in some sediment delivery. However, after the initial construction phase, a properly graded and drained trail would result in no measurable effects to the water resource.

Wildlife Activities

The effects of wildlife activities on water resources would be similar to those discussed under Alternative B. In addition to the activities proposed in Alternative B, the wildlife activities proposed in Alternative C include the following:

- Construction of three additional water features (for a total of five);
- Conversion of the temporary road accessing compartment 69, stand 17 to a 0.7-mile linear wildlife opening after completion of timber harvest activities; and
- Conversion of the proposed log landing in compartment 69, stand 17 to a 2-acre spot wildlife opening.

The conversion of the temporary road and log landing to wildlife openings under Alternative C would have the same stabilizing effects as the revegetation called for in BMPs under Alternative B. The construction of three additional waterholes would result in a minor increase in localized water retention. Given the small areas involved and locations on level terrain, direct and indirect effects would be approximately the same as Alternative B.

Prescribed Fire

Approximately 1,057 acres (two blocks) of prescribed burning are proposed in this alternative. Fire generally affects soil erodibility if mineral soil is exposed. Other than dozer or handline-created fireline, there would be little, if any, mineral soil exposure from the low intensity burns. Reports show little to no erosion (which can lead sediment movement into rivers and streams) after light to moderate intensity fires in the southeastern United States (Swift et al. 1993). However, burns conducted in areas with previous soil disturbance, such as where skidding of logs has occurred, increases the probability of soil erosion (and sedimentation) after burning (ibid).

Streamside areas would be minimally impacted by the proposed burns since no harvest would occur in riparian corridors and logging slash would not exist. Fires would be allowed to back down into streamside areas, but the fire typically does not carry far into these damper areas. In addition, Forestwide standards prohibit placing firelines in or adjacent to perennial, intermittent, or ephemeral streams (see UDSA Forest Service 2004a, FW-18 and 19, p. 27). Handlines must be used in these situations which results in less exposed mineral soil. Finally, since little vegetation mortality occurs in riparian areas from low-intensity burns, the vegetation within these areas would help trap and filter out sediment before runoff entered a stream.

Creating firelines around recently regenerated or privately-owned areas may be needed to facilitate protection from prescribed burning activities. Blading or plowing a fireline exposes mineral soil by removing vegetation, leaf litter and duff, thereby increasing the exposed areas' susceptibility to soil erosion and displacement of nutrients and organic matter offsite. Firelines can recover quickly, however, as they accumulate litter from the forest canopy and through revegetation efforts.

Firelines would control concentrated water flow and soil erosion by employing erosion control measures such as relatively permanent drainage dips, reverse grades, out-sloping and lead-off ditches along with other erosion control measures. Thus, the effects of firelines on sediment delivery would be minimized.

Cumulative Effects

Alternative C includes more commercial timber harvest than Alternative B and slightly less road building. Alternative C also proposes prescribed fire and road decommissioning and rehabilitation, and trail construction. Cumulative effects from the proposed activities under Alternative C would be similar to those discussed under Alternative B with the following additions.

The Rye Patch Knob prescribed burn (2,613 acres) was last conducted in 2005. The 1,057 acres of prescribed burns proposed in Alternative C would be cumulative with this burn. However, any cumulative effects would be negligible since: 1) firelines associated with the Rye Patch Knob burn would have healed since the burn was conducted, 2) fireline construction is prohibited in or adjacent to perennial, intermittent, or ephemeral streams, 3) fireline construction employs erosion control measures such as relatively permanent drainage dips, reverse grades, out-sloping and lead-off ditches along with other erosion control measures, 4) riparian vegetation would not have been/would not be affected by the past or present proposed burns since little to no vegetation mortality occurs in riparian areas from low-intensity burns, and 5) the retained riparian vegetation would filter sediment out of runoff before it entered a stream.

Road decommissioning and rehabilitation, when considered with past, present and reasonably foreseeable scheduled road maintenance and the proposed pre-haul maintenance, should improve the overall condition of the water resource in the cumulative effects analysis area, a beneficial cumulative effect.

Effects of the temporary road construction and multi-use trail construction would include soil erosion and potential sedimentation. However, with the application of Forest Service Standards and Guides and BMPs, the cumulative effects would be minimized.

Activities on private land beyond the forest service boundary would be expected to continue in the future. These activities, as described in the no action alternative, are typical community activities that involve road construction, structures, pastures, stream crossings, farming and timber harvesting. These activities would continue to impact water resources and, depending on scope, location and timing, would add, cumulatively, to any impacts from Alternative C.

Executive Orders 11988 (Floodplains) and 11990 (Wetlands)

The objective of EO 11988 is to avoid, to the extent possible, long- and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct or indirect support of floodplain development wherever there is a practicable alternative. Based on a review of detailed Forest-level NRCS soil mapping (2013) and FEMA Flood Maps (2012), there are no floodplains present in the project area. All alternatives are consistent with Executive Order 11988.

EO 11990 requires the Forest Service to take action to minimize the destruction, loss, or degradation of wetlands, and to preserve the natural and beneficial values of wetlands. Based on a

review of National Wetlands Inventory data (2013) and detailed Forest-level soil survey information (NRCS 2013b), there are no wetlands present in the project area. All alternatives are consistent with Executive Order 11990.

Forest Resources

Affected Environment

All acreages are from the Cherokee National Forest's Geographical Information System (GIS). Age class tables use 2013 as the base year. There may be some minor discrepancies when comparing total acres and percentages due to rounding.

The Stony Creek Analysis Area's (SCAA) forested acres have a dominant cover of deciduous species (Table 3f). Although conifer species such as white pine, shortleaf pine, pitch pine, etc, are present as dominant forest types, they make up only about 7% of the the forested acres. Conifers are more typically present as codominants or as minor components within a stand.

The most abundant forest type—White oak-Northern red oak-Hickory (FT 53: 34%) is present throughout the project area (Table 3f). Yellow poplar-White oak-Northern red oak (FT 56: 14%) is also found throughout the project area, but is primarily associated with drainages. Chestnut oak, either as a single species forest type or as a codominant with other species, makes up 30% of the SCAA forested acres. Yellow poplar, as a single species forest type (FT 50: 4%), is found mostly in the northeast portion of the analysis area. Southern red oak-Yellow pine (FT 44: 3%) is present as a single stand. The remaining forest types, including stands unclassified (Unc) to forest type, contain less than 2% each, and are found scattered throughout the SCAA.

Table 3f: Forest Type Distribution – All NFS lands

Forest Type	Acres	%	Description
53	10005	34%	White oak - Northern red oak - Hickory
56	4059	14%	Yellow poplar - White oak - No. red oak
45	3501	12%	Chestnut oak - Scarlet oak - Yellow pine
52	2950	10%	Chestnut oak
60	2311	8%	Chestnut oak - Scarlet oak
50	1209	4%	Yellow poplar
44	760	3%	Southern red oak - Yellow pine
55	716	2%	Northern red oak
59	544	2%	Scarlet oak
41	499	2%	Cove hardwoods - White pine - Hemlock
3	446	2%	White pine
32	370	1%	Shortleaf pine
16	259	1%	Virginia pine - Oak
15	255	1%	Pitch pine - Oak
38	208	1%	Pitch pine
10	197	1%	White pine - Upland hardwood
Unc	172	1%	Unclassified to Forest Type

Forest Type	Acres	%	Description
8	140	< 1%	Hemlock - Hardwood
42	121	< 1%	Upland hardwoods - White pine
48	118	< 1%	No. red oak – Hickory - Yellow pine
12	105	< 1%	Shortleaf pine - Oak
81	68	< 1%	Sugar maple – Beech - Yellow birch
33	44	< 1%	Virginia pine
4	14	< 1%	White pine - Hemlock
20	11	< 1%	Table Mountain pine- Hardwoods
88	7	< 1%	Black locust
Total acres	29,089		

Approximately 88% of the SCAA’s forested acres are late successional¹, i.e. greater than 80 years old, with 64% in the 81-110 age class and 24% in the 111 plus age class (Table 3g). This is likely due to extensive logging in the area beginning around the late 1800s to early 1900s, prior to Federal ownership. The remaining 12% is split between the mid-successional (41-80: 7%) and immature forest (11-40: 5%) age classes. There are no acres in the 0-10 age class. Note that less than 1% of the project area acres are unclassified (Unc) to age class.

¹ Early-successional forest is considered from 0-10 years old; immature forest 11 – 40 years old; mid [to late-] successional forest 41 - 80 years old; and late-successional forest greater than 80 years old.

**Table 3g: Current age class distribution
in Stony Creek Analysis Area**

Age Class	Acres	Percent
0-10	0	0%
11-40	1434	5%
41-80	1918	7%
81-110	18535	64%
111+	7001	24%
Unc	201	< 1%
Total	29,089	

Hemlock Woolly Adelgid (HWA) is widespread through the Stony Creek Analysis Area. There are currently three treatment sites in the area.

Scope of Analysis

Unless otherwise stated, the scope of analysis for effects to Forest Resources are National Forest System lands, specifically the suitable acres in prescription 7.E.2 in Compartments 55-78, hereafter defined as the project area. Cumulative effects includes private lands within the project area. The time frame for the cumulative effects analysis includes activities that occurred in these compartments within the last decade (i.e. 2002 – 2013) and the future decade (2014 – 2023). This time frame was chosen because the affects of and planning for major vegetation management activities that could noticeably affect age class distribution generally follows a 10-year planning cycle. There haven’t been any major regeneration activities in the project area in the last ten years.

Effects Analyses of the Alternatives

Alternative A (No Action)

Direct and Indirect Effects

Successional Stages

The distribution of successional stages for suitable 7.E.2 forested acres in the Stony Creek project area is shown in Table 3h. Displayed are current (2013) acres and current plus 10 years (2023) acres. The current plus 10 years column reflects the distribution of the age classes within the next decade in the absence of vegetation management, as proposed under Alternative A. Under Alternative A, late-successional forest (80+ year old) would show an approximate 3.2% gain overall during the next decade. The gain would be due to mid-successional forest maturing to the next successional stage (Table 3h). Immature forest would show an approximate 3.0% decline as the trees matured to the mid- to late-successional stage. This would essentially replace the trees in the mid- to late-successional stage that moved to the next successional stage. Early successional forest would remain the same but see below.

Table 3h: Alternative A - Current (2013) and plus 10 years (2023)
age class distribution of suitable acres in project area

Age Class	2013	%	2023	%
0-10	0	0.0%	0	0.0%
11-40	935	11.4%	690	8.4%
41-80	796	9.7%	782	9.6%
81-110	4,141	50.7%	3,890	47.6%
111+	2,297	28.1%	2,806	34.3%
Totals	8,169		8,169	

Natural disturbances such as high wind events, snow/ice, insect/desease outbreaks, fire, etc during the period would likely create patches of early successional forest. However, given the stochastic nature of these events, they are unpredictable as to time, location and size (acres), and therefore cannot be calculated.

Objective 7.E.2-1.01 (see USDA Forest Service 2004a, p. 132) is currently being met only for the late successional stages (Table 3i). Over the next decade, late successional forest would continue to increase: in 7.E.2 late successional forest would continue to dominate (82% of the forested area; Table 3i), while early successional forest would continue to be nonexistent (but see previous paragraph) from the project area. Immature forest would show a slight decrease as stands mature and move to the mid- to late-successional forest stage but are not replaced by maturing early successional forest. Mid- to late-successional forest would stay relatively the same: stands progressing to late forest would be replaced from within immature forest.

Table 3i: Successional stage percentages per RLRMP Objectives for suitable lands in Prescription 7.E.2 – Current and Plus 10 years

Successional Stage (age class)	2013	2023	RLRMP
Early (0-10)	0%	0%	4 – 10%
Immature (11-40)	11%	8%	NA
Mid- to Late- (41-80)	10%	10%	≥ 50%
Late (81 plus)	79%	82%	≥ 20%

Over time shade-tolerant species would gradually come to dominate the project area reducing its overall biological diversity. The reduction of diversity in age classes/successional stages would make the project area more susceptible to invasive species infestations, disease outbreaks, and natural storm events.

Old Growth

Old Growth must meet four criteria, as defined in “*Guidance for Conserving and Restoring Old Growth Forest Communities on National Forests in the Southern Region*” (Old Growth Guidance) (USDA Forest Service 1997). One criteria, minimum age, and depending on Community Type, can vary from 100 to 140 years old. GIS data shows approximately 11,996 acres of National Forest System lands within the project area currently at or greater than 100 years old (Table 3j). All the prescriptions in Table 3j (except for 7.E.2) are considered not suitable for timber production.

Table 3j: Acres > 100 years-old by prescription – All NFS lands

Prescription	Suitable (acres)	Non-suitable (acres)	Total (acres)
1.A	0	2,048	2,048
1.B	0	2,212	2,212
4.A	0	177	177
4.F	0	1,954	1,954
5.A	0	2	2
5.B	0	128	128
7.E.2	3,037	542	3,579
9.F	0	9	9
12.A	0	527	527
12.B	0	1,360	1,360
Totals	3,037	8,959	11,996

Alternative A would have no short-term impacts on Old Growth in the project area since the proposed actions would be deferred. This alternative would have a long-term impact on Old Growth by allowing stands to continue to mature, in the absence of a major disturbance, to the minimum age considered for Old Growth status.

Forest Health and Diversity

As shown in Table 3g, 88% of the all National Forest System lands in the Stony Creek project area is mature forest over 81 years old, and therefore would be susceptible to oak decline, gypsy moth, Southern Pine Beetle, Hemlock Woolly Adelgid, and other natural disturbances such as wildfire and high wind events. Approximately 12% is between 11 and 80 years old, and there is 0% regenerating forest (0-10 year age class). Deferring the vegetation management actions would not help improve general stand health, nor would it improve forest succession/age class diversity.

Cumulative Effects

When considered with past, present and reasonably foreseeable vegetation management actions, Alternative A would have a beneficial cumulative effect on Old Growth. Deferring the proposed vegetation management treatments would allow stands currently greater than 100 years old to continue to mature and, in the absence of major disturbance, help promote old growth conditions and characteristics per the Old Growth Guidance. This would be cumulative with allowing the NFS lands in the project area considered unsuitable for timber production to mature towards old growth conditions as well. The alternative would have a minor adverse cumulative impact since early successional forest would not be created which would maintain the current unfavorable age class diversity. There are no foreseeable future projects in this area for the next 10 years that would change age class or forest types.

Alternative B (Proposed Action)

Direct and Indirect Effects

Timber Harvest

This alternative proposes to regenerate approximately 351 acres (10 stands) utilizing commercial timber harvest and 32 acres (one stand) noncommercially. Approximately six miles of pre-haul road maintenance and 1.5 miles of temporary road construction are proposed under this alternative to support timber harvest.

An average basal area of 15-25 square feet per acre would be left on site to create a two-aged stand structure along with new regeneration. Each stand would have areas of higher basal area where favorable leave trees may be clumped as well as areas with lower basal area where fewer favorable leave trees occur. Some stands may also have areas of higher basal area due to mitigation for scenery (see Design Criteria Section, p. 29 - 30, and Scenery Effects Section, p. x - y of this EA). Trees selected as leave trees include all den trees, long-lived mast trees such as oaks, hickories and other hardwoods, and long-lived pine species such as shortleaf pine. These trees would remain through the next rotation. The shelterwood with reserves treatment would create a two-aged stand with an open overstory of mature hardwoods. Regeneration would be from natural seeds and sprouting. To supplement areas of low natural regeneration seedlings of blight resistant American chestnut and/or red oak would be planted, if seedlings become available.

Although some trees would be removed during temporary road construction, this would have negligible, if any, impacts on forest resources in the project area overall. After harvest operations were completed, the temporary roads would be closed, rehabilitated and the vegetation, including trees, allowed to reclaim the road footprint over time. Pre-haul maintenance would have no impacts since the activities would occur on existing roads.

With shelterwood harvesting, some residual trees would be damaged during the felling and skidding operations. Most of the damaged trees would recover quickly; however, open wounds would provide an entry point for insects and disease, and some of the damaged trees may die as a result. Dead standing trees would create snags, providing wildlife habitat.

One to three years prior to harvest, midstory species would be treated using herbicides to reduce post-harvest sprouting of overly-competitive species; non-native species would be treated as well. Midstory species not treated would include dogwood and hard-and soft-mast producing species. One to years following timber harvest, standing stems not retained as part of the shelterwood component would be mechanically slashed down and, where needed, herbicide applied to stems of overly-competitive species to favor mast-producing trees. Overly-competitive sprouts would again be treated using herbicides approximately two to four years later.

The relative abundance and diversity of individual tree species may vary from the stands pre-management composition after the timber sale was completed, but changes to forest type are not expected from the action. Post-harvest release treatments are designed to ensure the stands would have a strong component of mast-producing species to provide forage for wildlife over the long term. Without this treatment, species such as yellow poplar and red maple—species considered to provide poor forage for wildlife—would increase in relative abundance at the expense of more desirable species such as cherry, oaks, and hickories.

Successional Stages and Old Growth

Under Alternative B, early successional forest would increase from the current 0% to 4.7% of the project area (Table 3l). This would meet the early successional forest objective for 7.E.2 as found in the RLRMP.

Table 3l: Alternative B ESF Acres by Suitable Prescription

Prescription	ESH Objective in RLRMP	Total Acres	Suitable Acres	Acres Treated	Percent of Prescription
7.E.2	4% - 10%	11,144	8,168	383	4.7%

Alternative B would provide habitat for early successional forest species and increase the diversity of age classes in the Stony Creek project area. The creation of edge habitat would increase the area's overall biological diversity. Shade tolerant and mature forest species would likely experience a slight decrease in abundance over the short term due to the loss of late successional habitat. However, the impact would be minor given the current availability of mature forest that would remain in the area.

Alternative B would have a direct impact on Old Growth in the project area since three of the stands (118 acres total) proposed for early successional forest creation – Compartment 66, Stand 40 and Compartment 68, Stands 5 and 30 – currently meet the Old Growth Guidance's minimum age requirement. This alternative would have a minor long-term indirect impact on Old Growth within the project area since 265 acres would not mature to the minimum age for Old Growth status. The impact is considered minor since the 265 acres is approximately 2.4% of the 11,144 acres in the 7.E.2 prescription and < 1% of all NFS lands in the Stony Creek Assessment Area.

Forest Health and Diversity

Under Alternative B, the amount of suitable late successional forest (> 81 years-old) in the project area would be reduced by 4.3% (Table 3m). The reduction is due to the loss of 353 acres of late successional forest, primarily in the white oak-northern red oak-hickory forest type, for early successional forest habitat creation. However, at 74.5%, LSF would continue to be the predominant successional stage in the area. Mid- to late-successional forest (41-80 years-old) would decrease by less than one percent (0.3%) due to 30 acres of ESFH creation. This would have an extremely minor impact on the availability of this successional stage in the area, and on the recruitment of future late successional forest. This alternative would have no impacts on the availability of immature forest (11-40 years-old). The 4.1% increase in early successional forest would meet the RLRMP ESF objective of 4%-10% in the 7.E.2 prescription, and would help promote the age class diversity needed for a more resilient forest over the long term.

Table 3m: Alternative B - Current and Proposed Action age class distribution (base year = 2013) of suitable acres in the project area

Age class	Current	%	Alt B	%
0-10	0	0.0%	383	4.7%
11-40	911	11.2%	911	11.2%
41-80	819	10.0%	789	9.7%
81-110	4139	50.7%	3904	47.8%
111+	2300	28.2%	2182	26.7%
Totals	8169		8169	

Cumulative Effects

When considered with past, present and reasonably foreseeable future vegetation management projects, Alternative B would have an overall beneficial cumulative effect on forest resources. Although no early successional forest habitat has been created in the analysis area within the past 10 years and, other than the proposed project, none is planned in the future decade, the proposed regeneration of 383 acres under this alternative would enhance the diversity of age classes, successional stages and forest health in the project area. This would have beneficial cumulative impacts on wildlife habitat diversity and populations. Activities on private lands are not anticipated to affect the national forest lands.

Alternative C

Direct and Indirect Effects

Timber Harvest

This alternative proposes to regenerate approximately 302 acres (10 stands) through commercial timber harvest and 32 acres (one stand) noncommercially, encourage mast-producing species on approximately 116 acres (three stands) through mid and understory herbicide treatments, and thin 204 acres (six stands) using commercial harvest.

As with Alternative B, the shelterwood method would leave an average basal area of 15-25 square feet per acre to create a two-aged stand with an open overstory of mature hardwoods.

Regeneration would be from seeds and sprouting. One to three years prior to harvest, midstory species would be treated using herbicides (Glyphosate and/or Imazapyr) to reduce post-harvest sprouting of overly-competitive species, with non-native species being treated as well. Midstory species not treated would include dogwood and hard-and soft-mast producing species. One to two years following timber harvest, standing stems not being retained as part of the shelterwood component would be slashed down and, if needed, herbicide would be applied to stems of overly-competitive species to favor mast-producing trees. These site preparation activities would be repeated approximately two years later to again treat overly competitive sprouts. Post-harvest site preparation may be done via chainsaw slashdown, if and where herbicide is not needed. Blight resistant American chestnut and red oak seedlings would be planted in regenerated areas where needed to supplement natural regeneration.

Although some trees would be removed during temporary road construction, this would have negligible, if any, impacts on forest resources in the project area overall. After harvest operations were completed, the temporary roads would be closed, rehabilitated and the vegetation, including trees, allowed to reclaim the road footprint over time. Pre-haul maintenance would have no impacts since the activities would occur on existing roads.

The relative abundance and diversity of individual tree species may vary from the stands pre-management composition after the timber sale was completed, but forest type changes are not expected from the action. Post-harvest release treatments are designed to ensure the stands would have a strong component of mast-producing species to provide forage for wildlife over the long term. Without this treatment, species such as yellow poplar and red maple—species considered to provide poor forage for wildlife—would increase in relative abundance at the expense of cherry, oaks, and hickories.

The proposed thinning would result in a final basal area ranging from 35 to 60 ft²/acre. Damaged and diseased trees would be removed first followed by scarlet oak, black oak, red maple, and white pine. All stands proposed to be thinned would receive the same pre-harvest treatment as that described for the shelterwood treated stands. Post-harvest treatments in thinned stands would again be the same as for shelterwooded stands, but on a selective basis, i.e., not all thinned stands would receive post-harvest treatment. Thinning would enhance species sustainability and promote stand vigor by reducing competition for light, nutrients, and moisture, thus improving the general health of the forest in the treated stands over the long term..

Successional Stages and Old Growth

Under Alternative C, early successional forest would increase from the current 0% to 4.1% of the project area (Table 3n). This would meet the minimum early successional forest objective for 7.E.2 as found in the RLRMP.

Table 3n: Alternative C ESH Acres by Suitable Prescription

Prescription	ESH Objective in RLRMP	Total Acres	Suitable Acres	Acres Treated	Percent of Prescription
7.E.2	4% - 10%	11,144	8,168	335	4.1%

Alternative C would provide habitat for early successional forest species and increase the diversity

of age classes in the Stony Creek Project area. The creation of edge habitat would increase the area's overall biological diversity. Shade tolerant and mature forest species would likely experience a slight decrease in abundance over the short term due to the loss of late successional habitat. However, the impact would be minor given the current availability of mature forest that would remain in the area.

Alternative C would have a direct beneficial impact on existing Old Growth in the project area: Compartment 66, Stand 40 and Compartment 68, Stand 30, proposed for ESFH creation in Alternative B, would be dropped from ESFH creation. Although Compartment 68, Stand 28 would receive midstory treatment, the action would not alter the stand's Old Growth characteristics.

The stands proposed for early successional forest habitat creation under this alternative do not currently meet the Old Growth Guidance's minimum age requirement or does not meet all four criteria (see Table 2h, pp 23-24 of this EA). This alternative would have a minor long-term indirect impact on Old Growth within the project area since 335 acres would not be allowed to mature to the minimum age for Old Growth status. The impact is considered minor because the 335 acres is approximately 3% of the 11,144 total acres in the 7.E.2 prescription and < 1% of all NFS lands in the Stony Creek Assessment Area.

Forest Health and Diversity

Under Alternative C, the amount of suitable late successional forest (> 81 years-old) in the project area would be reduced by 3.8% (Table 3o). The reduction is due to the loss of 305 acres of late successional forest, primarily in the white oak-northern red oak-hickory forest type, for early successional forest creation. However, at 75.1%, LSF would continue to be the predominant successional stage in the area. Mid- to late-successional forest (41-80 years-old) would decrease by less than one percent (0.3%) due to 30 acres of ESF creation. This would have an extremely minor impact on the availability of this successional stage in the area, and on the recruitment of future late successional forest. This alternative would have no impacts on the availability of immature forest (11-40 years-old). The 4.1% increase in early successional forest would meet the RLRMP ESF objective of 4%-10% in the 7.E.2 prescription, and would help promote the age class diversity needed for a more resilient forest over the long term.

Table 3o. Alternative C – Current and Proposed Action age class distribution (base year = 2013) of suitable acres in the project area

Age class	Current	%	Alt C	%
0-10	0	0.0%	335	4.1%
11-40	911	11.2%	911	11.2%
41-80	819	10.0%	789	9.7%
81-110	4139	50.7%	3834	46.9%
111+	2300	28.2%	2300	28.2%
Totals	8169		8169	

The 204 acres of proposed release thinnings and 116 acres of midstory treatments would reduce the competition for sunlight and nutrients, thereby improving the general health of the forest in the treated stands over the long term.

Prescribed Burning

The primary objective of the prescribed burns proposed under this alternative is to promote the health of forest communities. The desired condition in the upland oak sites found in the proposed burn blocks, would be a mixed oak-shortleaf pine forest, with a reduced shrub (mountain laurel/rhododendron) layer, reduced red maple and white pine seedling/saplings, and a mosaic of grasses, forbs, soft-mast species, and regenerating oak species. This would be accomplished by first reducing the midstory/shrub component (primarily mountain laurel and rhododendron) within the burn area. The shrub component has become widespread due to years of fire exclusion and past management practices. In particular, mountain laurel and rhododendron have formed dense thickets of nearly impenetrable vegetation that excludes most other vegetative species. By reducing the number of these shrubs the burns would increase the levels of sunlight reaching the forest floor and increase the potential for natural regeneration of hard mast-producing trees such as oaks and hickory. The increased light would also promote the growth of new young grasses, herbs, and soft mast-producing shrubs and trees which would provide food for deer and turkeys, as well as soft mast for bears and other species.

Due to the prevalence of mountain laurel and rhododendron in the burn blocks, repeat burns may be required to achieve the objective. The initial burn and any needed repeat burns in the upland oak sites would reduce the seedling/sapling stages of red maple and white pine, giving the competitive advantage to hard mast species such as oaks and hickory. The low intensity burns would not affect the immature and mature mast-producing trees in the burn area but could set back most of the oak regeneration.

Other Actions

Alternative C proposes to decommission approximately 5.2 miles of Little Stony Road (FSR 202A) on National Forest System lands, convert part of the road to a hiking trail, obliterate and recontour sections of the roadbed, and construct a multi-use connector trail. See Chapter 2, Alternative C, action #8: Little Stony Road, for the full list and descriptions of the proposed activities. While this action would result in the loss of some trees in the short term due to the use of heavy equipment for roadbed rehabilitation activities and from the new trail construction (a minor impact), the rehabed sections of roadbed would revegetate over time, therefore the action would have no long-term impacts on forest resources within the project area.

Cumulative Effects

When considered with past, present and reasonably foreseeable future vegetation management projects, Alternative C's cumulative effects would be the same as those in Alternative B.

Health and Safety

Affected Environment

This section specifically discusses the effect of herbicide use on the health and safety of forest users and workers. Effects of herbicide use on other resources, such as soil, water, wildlife, etc, are discussed under their respective heading. Forest users and Forest workers occasionally visit the project areas. Hunters are most likely to visit these areas. Forest Service employees visit these areas while performing administrative and maintenance duties.

Scope of Analysis

The scope of analysis is the individual boundaries of the vegetation treatment areas proposed for herbicide use, as listed in the Alternative B, the Proposed Action (see pp.15-18 of this EA). The time frame is generally from when the first project area is treated to less than one year beyond the time when the last project area in this analysis is treated, about 10 years from present.

Effects Analysis of the Alternatives

Alternative A (No Action)

Direct, Indirect and Cumulative Effects

Under the No Action alternative, herbicides would not be used within the proposed treatment areas associated with the Stony Creek Project. There would be no increased health hazards or risks to forest users (general public) and Forest Service personnel beyond those already associated with recreating and working in a forested environment. There would be no cumulative effects to human health with this alternative.

Alternative B (Proposed Action)

Direct and Indirect Effects

Unless otherwise noted, information presented is from Risk Assessments prepared for the Forest Service by Syracuse Environmental Research Associates, Inc. (SERA). SERA Risk Assessments for individual herbicides may be found at: <http://www.fs.fed.us/foresthealth/pesticide/risk.shtml> Three herbicides are proposed for use on site preparation and release treatments. The chemicals are effective for situations encountered with this project, with negligible environmental impacts. The different chemicals were chosen because one is more effective on particular vegetation or in a particular situation than another. Which chemical to use would depend on the plant species to be controlled, the plant species to be released and maintained, and the overall objectives. The herbicides and typical Forest Service use rates are shown in Table 3p (and see Appendix C).

Table 3p: Herbicides and Use Rates

Herbicide	Use Rate Per Acre	Remarks
Glyphosate	2.0 lbs a.e.*	Formulations without surfactants
Triclopyr	1.0 lbs a.e.	
Imazapyr	0.15 lbs a.e.	

* a.e. = acid equivalents

Herbicides would be used within an area of up to 383 acres in this alternative, but not all of the area would be treated due to the selective nature of the applications. Approximately 92.0 lbs a.e. of Glyphosate, 3.9 lbs a.e. of Imazapyr, and 1.1 lbs a.e. of Triclopyr, for a total of 97.0 lbs a.e. of chemical would be used on the project area. This use is, on average, about 0.25 lbs a.e./acre.

The mitigation measures (design criteria) are designed to minimize human health risks. Following all handling, application and safety instructions would further reduce risks. Forest users may encounter herbicide treated areas as they visit the forest. Signage during treatment would discourage use of the area. Forest workers applying the herbicides are exposed for longer periods and to more volume of herbicide than a casual forest visitor. At typical Forest Service use levels

the SERA Risk Assessments for all three chemicals states that there is little potential risk to the health of workers and the general public. Table 3q provides a comparison of common health risks for the three chemicals:

Table 3q: Comparison of Common Health Risks for Glyphosate, Triclopyr and Imazapyr

Herbicide	Toxicity¹	Carcinogenic	Irritating to skin and eyes	Birth defects	Persistence
Glyphosate	low	no evidence	non to slightly irritating	not observed	not persistent
Triclopyr	low	marginally	slightly irritating	at toxic levels ²	not persistent
Imazapyr	low	no evidence	irritating	not observed	not persistent

¹ Toxicity to mammals (SERA); for comparison, caffeine has a moderate toxicity (USDA, Forest Service 1989)

² No birth defects were observed below levels that Triclopyr is toxic; extremely high levels of chemical, above that which would kill the test subject, are required to cause birth defects

JLB Oil

JLB Oil, a mineral oil, is used as an adjuvant to mix with the formulation of Triclopyr sold under such brand names as Garlon 4. Mineral oils are classified as very slightly toxic, are slight skin irritants, but not eye irritants. There is no evidence for carcinogenicity (USDA, Forest Service 1989).

Cumulative Effects

There are no planned uses of herbicides in the cumulative effects analysis area, other than those proposed in the Stony Creek Project, within the next 10 years. With the mitigation measures and application precautions in place, the herbicides are not expected to leave the treatment areas, nor are they expected to enter them from other treatment areas. Due to the spatial arrangement of the proposed NNIS treatment areas and the time frames when they may be treated, it is highly unlikely that any one forest user would visit multiple-treated areas during the time when exposure to the chemicals might occur. Forest workers would not work in multiple areas within a time frame that would result in cumulative effects. This is due to the rapid elimination and lack of persistence of these chemicals in the body which would preclude accumulation to the point of having a cumulative effect. Also, the SERA Risk Assessment states that repeated exposures below a toxic threshold should not be associated with cumulative toxic effects. Based on this analysis, cumulative effects from herbicide use are not expected with this alternative.

Alternative C

Direct and Indirect Effects

Although Alternative C would result in an increase in the amount of herbicide use due to the addition of thinning activities, the overall impacts to health and safety from activities proposed under Alternative C would be the same as those analyzed under Alternative B. See Health and Safety, Alternative B. The addition of the prescribed burning and road decommissioning and rehabilitation would have negligible to no impacts on health and safety since neither action includes the use of herbicides.

As with Alternative B, three herbicides are proposed for use on site preparation and release treatments, and to treat non-native invasive plant species. The chemicals are known to be effective for situations encountered with this project, with negligible environmental impacts. Which

chemical to use would depend on the plant species to be controlled, the plant species to release and maintain, and the overall objectives. The mitigation measures that are a part of the proposed action would be applied to this alternative as well, and are designed to minimize human health risks.

The SERA Risk Assessments for all three chemicals states that at the typical Forest Service use levels there is little potential risk to the health of workers and the general public.

Cumulative Effects

Cumulative effects from Alternative C would be the same as those described for Alternative B above, i.e. there would be no cumulative effects on the health of Forest Service workers and the general public from herbicide use expected with Alternative C.

Biological Resources

Terrestrial Resources

Affected Environment

Analysis of effects to biological resources loosely follows the framework used in the RLRMP to ensure comprehensive consideration of project effects. The management indicator species (MIS), demand, rare, and non-native invasive species (NNIS) are analyzed using the best available science, including species habitat requirements, current project area data, and field surveys. Species that occur in the areas proposed for treatment and/or have the potential to be impacted by the alternatives will be discussed. Other species identified in the RLRMP that do not occur and/or would not be impacted are not discussed further in this document.

Scope of Analysis

The scope of analysis for available habitat, direct and indirect effects to terrestrial wildlife resources (Management Indicator Species, Demand Species and Rare Species) includes all National Forest System lands within the Stony Creek Analysis Area (SCAA). The cumulative effects analysis includes private lands within the SCAA.

The timeframe for short-term effects would be for the duration of project implementation. For long-term effects, the timeframe would be through the next 20 years. This time frame was selected to address past actions that currently provide early successional forest habitat and future conditions at the project level that, after 20 years, would resemble conditions present today. For cumulative effects, the timeframe is the past five years through five years in the future. Table 3r lists activities in the analysis area considered for cumulative effects.

Table 3r: Activities Considered in Cumulative Effects Analysis

Activity	Acres	Past 5 years	Future 5 Years
Rye Patch Knob Burn	2,613	No	Yes
Big Gap Burn	135	Yes	No
Lindy Camp Burn	348	No	Yes
Old Road Ridge Burn	2,272	No	Yes

Management Indicator Species

For information on distribution and life history, see Management Indicator Species (MIS) and Demand Species of the Northern CNF (Thomas 2012). Table 3s lists MIS considered in detail in the analysis area. Acadian flycatcher was considered, but dropped from detailed analysis because riparian forest habitats would be protected and no effects would occur to this species from any alternative. Note: Black bear, both an MIS and a Demand species, is discussed in the demand species section.

Table 3s: MIS of the Stony Creek Analysis Area

Management Indicator Species	Representative Habitat	Acres of Habitat	Percent of Analysis Area	CNF Population Trend
Prairie warbler	Early successional forest (ESF)	75	0.3%	NCT* (4.1%)
Chestnut-sided warbler	High elevation early successional (HESH)	75	0.3%	NCT* (-2.4%)
Hooded warbler	Mid-late successional mesic deciduous (MDF)	15,455	53%	Decline (-1.8%)
Ovenbird	Mature deciduous forest interiors	25,683	88%	Increase (1.4%)
Pileated woodpecker	Abundance of snags (late successional forest)	25,323	87%	Increase (2.1%)
Scarlet tanager	Mid-late successional oak/oak-pine (OOPF)	20,058	69%	NCT* (0.5%)

* NCT – No Conclusive Trend; 90% confidence interval does not indicate reliable results

Demand Species

For information on distribution and life history, see Management Indicator Species (MIS) and Demand Species of the Northern CNF (Thomas 2012). Table 3t lists Demand species in the affected areas of the analysis area.

Table 3t: Demand Species of the Stony Creek Analysis Area

Demand Species	Key Habitat	Acres	Percent of AA	Population Trend - CNF
Black bear	Denning	25,253	87%	Increase
	Foraging	20,442	70%	
Ruffed grouse	Nesting	1,522	5%	Decline
	Brood Rearing	150	1%	
	Spring/Summer	384	1%	

Rare Species

Twelve animal and 16 plant species found on the CNF Species Viability List (USDA Forest Service 2004a) have been detected within areas proposed for treatment (Table 3u). Threatened and Endangered species are discussed in more detail in the *Biological Assessment for the Stony Creek*

Project (Carter 2013). Sensitive species listed in Table 2 are also addressed in the *Biological Evaluation for the Stony Creek Project* (Carter and McGuiness 2013). Additional information on rare plants can be found in *Stony Project Rare Plant Analysis by Survey Site* (McGuiness 2013).

Table 3u. Rare Species and Habitats* in Stony Creek Analysis Area

Scientific Name	Common Name	Status ¹	Canopy Gaps	Dry Forests	Mesic Forests	Riparian Wetland	Cliffs Rocks
<i>Amphibians/Fish/Reptiles</i>							
<i>Plethodon yonahlossee</i>	Yonahlossee salamander	VC					
<i>Mammals</i>							
<i>Myotis grisescens</i>	Gray bat	E					
<i>Myotis leibii</i>	Eastern small-footed bat	S					
<i>Myotis sodalis</i>	Indiana bat	E					
<i>Birds</i>							
<i>Antrostomus (Caprimulgus) vociferus</i>	Whip-poor-will	VC					
<i>Corvus corax</i>	Common raven	VC					
<i>Dendroica fusca</i>	Blackburnian warbler	VC					
<i>Invertebrates</i>							
<i>Paravitrea placentula</i>	Glossy supercoil (snail)	S					
<i>Vertigo bollesiana</i>	Delicate vertigo (snail)	S					
<i>Vertigo clappi</i>	Cupped vertigo (snail)	S					
<i>Ventridens coelaxis</i>	Bidentate dome (snail)	S					
<i>Speyeria diana</i>	Diana fritillary (butterfly)	S					
<i>Plants (vascular)</i>							
<i>Carex aestivalis</i>	Summer sedge	VC					
<i>Carex platyphylla</i>	Broadleaf sedge	VC					
<i>Cymophyllus fraserianus</i>	Fraser's sedge	VC					
<i>Dryopteris carthusiana</i>	Spinulose shield fern	VC					
<i>Eupatorium steelei</i>	Steele's Joe-pye-weed	VC					
<i>Gentiana austromontana</i>	Appalachian gentian	S					
<i>Helianthus glaucophyllus</i>	Whiteleaf sunflower	S					
<i>Isotria verticillata</i>	Large whorled pogonia	VC					
<i>Juncus gymnocarpus</i>	Coville's rush	VC					
<i>Platanthera orbiculata</i>	Large round-leaved orchid	VC					
<i>Platanthera peromoena</i>	Purple fringeless orchid	VC					
<i>Prenanthes roanensis</i>	Roan Mountain rattlesnake root	S					

Scientific Name	Common Name	Status ¹	Canopy Gaps	Dry Forests	Mesic Forests	Riparian Wetland	Cliffs Rocks
<i>Plants (vascular)</i>							
<i>Pyrola rotundifolia</i> var. <i>americana</i>	American wintergreen	VC					
<i>Sanicula trifoliata</i>	Large-fruited snakeroot	VC					
<i>Trillium undulatum</i>	Painted trillium	VC					
<i>Tsuga caroliniana</i>	Carolina hemlock	S					

* Dark blocks indicate habitat(s) use by species.

¹ Status: E-Endangered; S-Sensitive; VC-Viability Concern: LR-Locally Rare

Effects Analyses of the Alternatives

Management Indicator Species

Alternative A (No Action)

Direct and Indirect Effects

Under Alternative A, habitat for and populations of *hooded warbler*, *ovenbird*, *pileated woodpecker*, and *scarlet tanager* would continue their current trends (Table 3s). *Chestnut-sided warbler* and *prairie warbler* breeding habitat and populations would remain low in the analysis area due to continually limited amount of HESH/ESF and loss of sapling/pole forest (SPF) in the next 20 years. Suitable habitat for chestnut-sided and prairie warblers would be restricted to small patches created by natural disturbances and along the edges of roads and spot openings.

Cumulative Effects

The No Action alternative would have no cumulative effects on *chestnut-sided warbler*, *prairie warbler*, *hooded warbler*, *ovenbird*, *pileated woodpecker*, or *scarlet tanager* because any action would be deferred and would not be cumulative with other activities in the analysis area. Populations would continue on their current trends (see Table 3s).

Alternative B (Proposed Action)

Direct and Indirect Effects

Chestnut-sided warbler would not be directly impacted because no activities would occur in existing habitat. Currently, habitat for this species is scarce in the analysis area.

Foraging and nesting habitat would become available by the addition of 194 acres of HESH. This species reaches its highest densities in ESF which provide increased vegetation complexity (Richardson et al 1995). With the absence of natural disturbance such as fire, clear-cutting or similar activities effectively provide early-successional habitat (NatureServe 2012). Creation of ESF and post-cutting treatments proposed in Alternative B would ensure population increases and continued existence of habitat in the analysis area.

After ESF creation, 194 acres of HESH suitable for occupation would be treated with herbicides, but only a portion of the acres treated would be directly impacted. The herbicides proposed may come into contact with nesting birds and may be present on insects eaten. The herbicides used,

however, are of low toxicity to birds (Tu et al 2001). The following factors would minimize the risk of contamination: 1) herbicides would be applied in small amounts; 2) specific methods of application such as thinline or stump treatments would limit exposure; 3) use of design criteria for herbicides, e.g. timing to avoid rainfall; and 4) birds are highly mobile and would leave the area during treatment, if they are not nesting.

Other proposed activities including crop tree release, nest/bat box and log installation, waterhole construction, and road activities would not occur in suitable habitat or create habitat, and would have no effect on chestnut-sided warblers.

Prairie warbler would not be directly impacted because no activities are proposed for existing ESF habitat. Currently, habitat for this species is scarce in the analysis area. Foraging and nesting habitat would increase by the creation of 189 acres of low elevation ESF in the analysis area. Without naturally occurring fires, active management is necessary to create the ESF required and to maintain a mosaic of forests in different successional stages (NatureServe 2012). Tree cutting and post-cutting treatments in these areas would ensure the continued existence of habitat and population increases in the analysis area.

After harvest, 189 acres of ESF suitable for occupation would be treated with herbicides, but only a portion of the acres treated would be directly impacted. The herbicides proposed may come into contact with nesting birds and may be present on insects eaten. The herbicides used, however, are of low toxicity to birds (Tu et al 2001). The following factors would minimize the risk of contamination: 1) herbicides would be applied in small amounts; 2) specific methods of application such as thinline or stump treatments would limit exposure; 3) use of design criteria for herbicides, e.g. timing to avoid rainfall; and 4) birds are highly mobile and would leave the area during treatment, if they are not nesting.

Other proposed activities including crop tree release, nest/bat box and log installation, waterhole construction, and road activities would not occur in suitable habitat or create habitat, and would have no effect on prairie warblers.

Hooded warbler would be directly impacted by this alternative. ESF creation, crop tree release, and road construction implemented during breeding season would disrupt nesting behavior, potentially causing mortality of young in the nest. Mortality would be likely if shrubs with nests are cut or are crushed by fallen trees or heavy equipment. Because implementation would occur over time, and not all at once, impacts to the species would be short term. Impacts would be considered minor in context of the surrounding landscape where suitable habitat is abundant.

Breeding habitat (mature MDF) would be altered on approximately 264 acres. The creation of ESF would create canopy gaps, increasing the shrub component that is essential for nesting. Hooded warblers commonly occupy ES and remain as long as the shrub layer is suitable (Ogden and Stuchbury 1994). They have been found using deciduous clear-cuts in Tennessee, with population density increasing from two to nine years after harvest (Nicholson 1997). Although these birds inhabit ESF, they are more abundant in mature forests with dense understory (NatureServe 2012). Breeding birds may move to adjacent areas with suitable habitat or they may nest within the harvested areas. Mature MDF in adjacent areas and streamside management zones within harvested areas (with dense shrub components) would continue to provide ideal nesting habitat for the species.

Post-harvest treatments in newly created ESF would decrease the understory but would create a more diverse shrub layer over time as more sunlight is allowed to the forest floor. Crop tree release would stimulate understory growth, promoting the return of a thicker shrub layer over time. ESF creation and crop tree release would increase sunlight and insect production in treated areas, improving foraging habitat.

Under this alternative, approximately 264 acres of hooded warbler habitat would be treated using herbicides, but only a portion of the acres treated would be directly impacted. The herbicides proposed may come in contact with nesting birds and may be present on insects eaten. The herbicides used, however, are of low toxicity to birds (Tu et al 2001). The following factors would minimize the risk of contamination: 1) herbicides would be applied in small amounts; 2) specific methods of application such as thinline or stump treatments would limit exposure; 3) use of design criteria for herbicides, e.g. timing to avoid rainfall; and 4) birds are highly mobile and would leave the area during treatment, if they are not nesting.

Other proposed activities including nest/bat box and log installation, waterhole construction, and other road activities would not occur in suitable habitat or create habitat, and would have no effect on hooded warblers.

Although hooded warbler habitat would be altered in the analysis area through the creation of ESF, approximately 898 acres of MDF would mature over the next 20 years, allowing for an overall increase of habitat. The amount of habitat available across the analysis area would remain sufficient to support the species' breeding requirements. Impacts from this alternative would not negatively influence the population trends in the analysis area.

Ovenbird would be directly impacted by this alternative. Activities implemented during breeding season would disrupt nesting behavior and potentially cause mortality of young if they are present in the nest. Since the species nests on the ground, nests and offspring could be crushed by soil movement, falling trees, or heavy equipment during harvest and road construction. Because implementation would occur over time, and not all at once, impacts to the species would be short term. Impacts would be considered minor in context of the surrounding landscape where suitable habitat is abundant.

Suitable breeding habitat would decrease by 383 acres through shelterwood harvest. Ovenbirds prefer a more closed canopy and are absent or at low densities in areas with open overstory (NatureServe 2012). The removal of most of the overstory to create ESF would have a negative impact on habitat suitability in cut stands. Local population densities would decline in the newly created ESF and remain low until canopy closure, in up to 20 years. Habitat would not be reduced by crop tree release because the overstory canopy would remain intact.

Under this alternative, approximately 383 acres of ovenbird habitat would be treated using herbicides, but only a portion of the acres treated would be directly impacted. The affected habitat would not be treated with herbicides until after cutting when habitat would no longer be suitable for ovenbirds. The herbicides proposed may come into contact with nesting birds and may be present on insects eaten. The herbicides used, however, are of low toxicity to birds (Tu et al 2001). The following factors would minimize the risk of contamination: 1) herbicides would be applied in small amounts; 2) specific methods of application such as thinline or stump treatments

would limit exposure; 3) use of design criteria for herbicides, e.g. timing to avoid rainfall; and 4) birds are highly mobile and would leave the area during treatment, if they are not nesting.

Other proposed activities including nest/bat box and log installation, waterhole construction, and other road activities would have no effect on ovenbird.

Although ovenbird habitat would be reduced in the analysis area through the creation of ESF, 1,023 acres of deciduous forests would mature over the next 20 years, resulting in an increase in habitat. The amount of habitat available across the analysis area would remain abundant and would support the species' breeding requirements. The population in the analysis area would be expected to continue on its current positive trend.

Pileated woodpecker would be directly impacted by this alternative. Tree cutting and road construction during the breeding season may disrupt nesting behavior, but pileated woodpeckers are relatively tolerant of human disturbance around nest sites (Bull and Jackson 1995). Although snags would be protected from cutting, mortality of young may occur if a nest tree is hit by a falling tree. Because implementation would occur over time, and not all at once, impacts to the species would be short term. Impacts would be considered minor in context of the surrounding landscape where suitable habitat is abundant.

Nesting habitat would be impacted by creation of 383 acres of ESF. The decrease in canopy closure and the loss of most large live trees as a result of tree cutting would reduce the quality of nesting habitat (Bull and Jackson 1995). However, the implementation of RLRMP standards regarding snag retention and den trees would provide some protection. Remaining snags and den trees would continue to provide drumming and nest sites. The resulting damage to the trees left standing after harvest may create additional snags in the future, allowing for more nesting cavities and drumming sites.

This species commonly forages in younger forests. Standing snags and logs left on the ground after harvest would increase areas for foraging.

Under this alternative, approximately 383 acres of potential habitat would be treated using herbicides, but only a portion of the acres treated would be directly impacted. Herbicides proposed for treatments are unlikely to contact pileated woodpeckers directly but may be present on plants and insects eaten. The herbicides used, however, are of low toxicity to birds (Tu et al 2001). The following factors would minimize the risk of contamination: 1) herbicides would be applied in small amounts; 2) specific methods of application such as thinline or stump treatments would limit exposure; 3) use of design criteria for herbicides, e.g. timing to avoid rainfall; and 4) birds are highly mobile and would leave the area during treatment, if they are not nesting.

Other proposed activities including nest/bat box and log installation, waterhole construction, and other road activities would have no effect on pileated woodpecker.

The approximately 714 acres of mid-successional forest that would move into the late successional stage over the next 20 years, along with an increase in snags created by insect infestations and disease, would increase habitat availability for pileated woodpecker. The population in the analysis area would be expected to continue on its current positive trend.

Scarlet tanager would be directly impacted by this alternative. Tree cutting and road construction during breeding season would disrupt nesting behavior. Studies indicate that scarlet tanagers abandon nest sites if logging occurs in occupied breeding habitat during nesting (Mowbray 1999). Felling of trees with nests would cause mortality of young. Because implementation would occur over time, and not all at once, impacts to the species would be short term. Impacts would be considered minor in context of the surrounding landscape where suitable habitat is abundant.

Breeding habitat suitability would be reduced on the 373 acres of proposed ESF. Since some trees will remain in the newly created ESF, tanagers may continue to nest there. Where they do not overlap with summer tanagers (as is the case in the analysis area), scarlet tanagers occupy more open habitat and are not restricted to dense canopy cover (Nicholson 1997). Scarlet tanagers may reoccupy harvested areas as early as 12 years after cutting if some small trees are left standing. They tolerate small or narrow clear-cuts, thinning, and selection cutting (NatureServe 2012).

The proposed crop tree release on 9 acres of OOPF would not reduce habitat suitability. ESF creation and crop tree release would allow more sunlight into treated areas, increase insect production, and improve foraging habitat for the species.

Under this alternative, approximately 373 acres of scarlet tanager habitat would be treated using herbicides, but only a portion of the acres treated would be directly impacted. The affected areas would not be treated with herbicides until after harvest when habitat would no longer be as suitable for nesting. Therefore, the potential for impacts would be slight in those areas. Herbicides proposed for treatments are unlikely to contact scarlet tanagers directly because these birds stay high in the canopy away from herbicide applications. Herbicides may be present on plants and insects eaten. The herbicides used, however, are of low toxicity to birds (Tu et al 2001). The following factors would minimize the risk of contamination: 1) herbicides would be applied in small amounts; 2) specific methods of application such as thinline or stump treatments would limit exposure; 3) use of design criteria for herbicides, e.g. timing to avoid rainfall; and 4) birds are highly mobile and would leave the area during treatment, if they are not nesting.

Other proposed activities including nest/bat box and log installation, waterhole construction, and other road activities would have no effect on scarlet tanager.

Although scarlet tanager habitat would be reduced in the analysis area through the creation of ESF, 824 acres of OOPF would mature over the next 20 years, resulting in an increase in optimal habitat. The amount of habitat available across the analysis area would remain abundant and would support the species' breeding requirements. The alternative would not negatively influence the population trend in the analysis area.

Cumulative Effects for Alternative B

Alternative B would have a positive cumulative effect on *chestnut-sided warbler* habitat by increasing the amount of habitat for the species in the analysis area. Because no HESH has been created in the last 10 years, no past activities would be cumulative with the proposed creation of HESH. Small patches HESH may be created by future prescribed burning and natural disturbances. By providing a shifting mosaic of HESH, the alternatives would help lessen the negative population trend of chestnut-sided warbler and ensure its viability across the CNF.

Alternative B would have a positive cumulative effect on *prairie warbler* habitat by increasing the amount of habitat for the species in the analysis area. Because no low elevation ESF has been created in the last 10 years, no past activities would be cumulative with the proposed creation of 189 of ESF. Small patches of ESF habitat may be created by future prescribed burning and natural disturbances. By providing a shifting mosaic of low elevation ESF, the alternatives would help lessen the negative population trend of prairie warbler in the analysis area and ensure its viability across the CNF.

Alternative B would have a slight adverse cumulative effect on *hooded warbler* habitat within the analysis area. Prescribed burning would not create canopy gaps due to the moist conditions in hooded warbler habitat. However, fire may consume the dense shrub layer that provides hooded warbler habitat in some areas. This would occur in patches across the burn, so habitat would remain available throughout. Suitable habitat would continue to be abundant and widespread. Hooded warbler populations would not likely decline. The alternatives would not threaten the viability of hooded warbler across the CNF.

Alternative B would have an adverse cumulative effect on *ovenbird* within the analysis area. Prescribed burning would have short term detrimental effects. Ovenbirds nest in areas with thick leaf litter and use leaves and small twigs to build nests on the ground. Fire would eliminate much of the nesting habitat in the burn areas, but leaf litter levels would recover within one to two years. Fire burns in a mosaic pattern, leaving patches of unburned leaf litter, so nesting habitat would remain scattered across the burn units. Ovenbirds would not be eliminated from burned areas, but densities would be reduced. Populations would return to previous levels within a few years after burning. The reduction of leaf litter would improve ground foraging conditions for this species, which has been found foraging in burned areas (Artman et al 2001). Past, proposed, and future activities combined would impact ovenbird habitat throughout the analysis area. Because these activities would occur over a long period and many of the impacts would be short term, habitat would remain abundant in the analysis area. Therefore populations would be unlikely to show a notable decline. The alternatives would not threaten the viability of ovenbird across the CNF.

When combined with past and future thinning and burning, Alternative B would have a cumulative effect on *pileated woodpecker*. Additional habitat (snags and downed logs) would be created by implementation of this alternative and by future prescribed burning. Foraging habitat would be improved throughout the analysis area with the combination of these actions. Habitat would remain widely available in the analysis area. Population trends for pileated woodpecker would be expected to continue on a positive trend in the analysis area, and the species population would remain viable across the CNF.

Alternative B would have a slight adverse cumulative effect on *scarlet tanager* within the analysis area. Past and future prescribed burning would not destroy nesting habitat but may create small patches of ESF, which tanagers will tolerate (NatureServe 2012). Since the combined proposed timber harvest and past and future prescribed burns would impact but not eliminate scarlet tanager habitat throughout the analysis area, suitable habitat would continue to be abundant and widespread. Therefore, the species population would be unlikely to show a notable decline. The alternatives would not threaten the viability of scarlet tanager across the CNF.

Alternative C

Direct and Indirect Effects

Chestnut-sided warbler would not be directly impacted because no activities would occur in existing habitat. Currently, habitat for this species is scarce in the analysis area.

Foraging and nesting habitat would become available by the addition of 116 acres of HESH. This species reaches its highest densities in ESF that provide increased vegetation complexity (Richardson et al 1995). With the absence of natural disturbance such as fire, clear-cutting or similar activities effectively provide early-successional habitat (NatureServe 2012). Creation of ESF and post-cutting treatments proposed in Alternative C would ensure population increases and continued existence of habitat in the analysis area.

After ESF creation, 116 acres of HESH suitable for occupation would be treated with herbicides, but only a portion of the acres treated would be directly impacted. The herbicides proposed may come into contact with nesting birds and may be present on insects eaten. The herbicides used, however, are of low toxicity to birds (Tu et al 2001). The following factors would minimize the risk of contamination: 1) herbicides would be applied in small amounts; 2) specific methods of application such as thinline or stump treatments would limit exposure; 3) use of design criteria for herbicides, e.g. timing to avoid rainfall; and 4) birds are highly mobile and would leave the area during treatment, if they are not nesting.

Burning in the Griffith Branch Burn area would occur in the spring before warblers return for breeding season. No birds or existing habitat would be impacted. However, if small pockets of trees are burned to create openings, additional habitat may be created. Burning may also increase insect production and improve foraging conditions.

Other proposed activities including thinning, midstory, crop tree release, nest/bat box and log installation, waterhole construction, and road activities would not occur in suitable habitat or create habitat, and would have no effect on chestnut-sided warblers.

Prairie warbler would not be directly impacted because no activities are proposed for existing ESF habitat. Currently, habitat for this species is scarce in the analysis area. Foraging and nesting habitat would increase by the creation of 218 acres of low elevation ESF and 204 acres of thinning in the analysis area. Without naturally occurring fires, active management is necessary to create the ESF required and to maintain a mosaic of forests in different successional stages (NatureServe 2012). Tree cutting and post-cutting treatments in these areas would ensure the continued existence of habitat and population increases in the analysis area.

After harvest, 422 acres of ESF suitable for occupation would be treated with herbicides, but only a portion of the acres treated would be directly impacted. The herbicides proposed may come into contact with nesting birds and may be present on insects eaten. The herbicides used, however, are of low toxicity to birds (Tu et al 2001). The following factors would minimize the risk of contamination: 1) herbicides would be applied in small amounts; 2) specific methods of application such as thinline or stump treatments would limit exposure; 3) use of design criteria for herbicides, e.g. timing to avoid rainfall; and 4) birds are highly mobile and would leave the area during treatment, if they are not nesting.

Burning in the Weaver Branch Burn area would occur in the spring before warblers return for breeding season. No birds or existing habitat would be impacted. However, if small pockets of trees are burned to create openings, additional habitat may be created. Burning may also increase insect production and improve foraging conditions.

Other proposed activities including midstory, crop tree release, nest/bat box and log installation, waterhole construction, and road/trail activities would not occur in suitable prairie warbler habitat or create habitat, and would have no effect on prairie warblers.

Hooded warbler would be directly impacted by this alternative. ESF creation, thinning, midstory, crop tree release, and road construction implemented during breeding season would disrupt nesting behavior, potentially causing mortality of young in the nest. Mortality would be likely if shrubs with nests are cut or are crushed by fallen trees or heavy equipment. Because implementation would occur over time, and not all at once, impacts to the species would be short term. Impacts would be considered minor in context of the surrounding landscape where suitable habitat is abundant.

Breeding habitat (mature MDF) would be altered on approximately 486 acres. The creation of ESF and thinning would create canopy gaps, increasing the shrub component that is essential for nesting. Hooded warblers commonly occupy ESF and remain as long as the shrub layer is suitable (Ogden and Stuchbury 1994). They have been found using deciduous clear-cuts in Tennessee, with population density increasing from two to nine years after harvest (Nicholson 1997). Although these birds inhabit ESF, they are more abundant in mature forests with dense understory (NatureServe 2012). Breeding birds may move to adjacent areas with suitable habitat or they may nest within the harvested areas. Midstory treatments would have minor impacts to habitat, possibly reducing the shrub component. Mature MDF in adjacent areas and streamside management zones within harvested areas (with dense shrub components) would continue to provide ideal nesting habitat for the species.

Post-harvest treatments in newly created ESF would decrease the understory but would create a more diverse shrub layer over time as more sunlight is allowed to the forest floor. Crop tree release would stimulate understory growth, promoting the return of a thicker shrub layer over time. ESF creation and crop tree release would increase sunlight and insect production in treated areas, improving foraging habitat.

Under this alternative, approximately 264 acres of hooded warbler habitat would be treated using herbicides, but only a portion of the acres treated would be directly impacted. The herbicides proposed may come into contact with nesting birds and may be present on insects eaten. The herbicides used, however, are of low toxicity to birds (Tu et al 2001). The following factors would minimize the risk of contamination: 1) herbicides would be applied in small amounts; 2) specific methods of application such as thinline or stump treatments would limit exposure; 3) use of design criteria for herbicides, e.g. timing to avoid rainfall; and 4) birds are highly mobile and would leave the area during treatment, if they are not nesting.

Burning would occur in the spring before warblers return for breeding season. No birds or existing habitat would be impacted. Burning may decrease the understory in drier areas, but would have little impact in more mesic sites. Burning would increase insect production and foraging quality.

Other proposed activities including nest/bat box and log installation, waterhole construction, and other road activities would not occur in suitable habitat or create habitat, and would have no effect on hooded warblers.

Although hooded warbler habitat would be altered in the analysis area through the creation of ESF, approximately 898 acres of MDF would mature over the next 20 years, allowing for an overall increase of habitat. The amount of habitat available across the analysis area would remain sufficient to support the species' breeding requirements. Impacts from this alternative would not negatively influence the population trends in the analysis area.

Ovenbird would be directly impacted by this alternative. Activities implemented during breeding season would disrupt nesting behavior and potentially cause mortality of young if they are present in the nest. Soil movement, falling trees, or heavy equipment could crush nests and offspring during harvest and road construction or recontouring since the species nests on the ground. Because implementation would occur over time, and not all at once, impacts to the species would be short term. Impacts would be considered minor in context of the surrounding landscape where suitable habitat is abundant.

Suitable breeding habitat would decrease by 335 acres through shelterwood harvest and 204 acres of thinning. Ovenbirds prefer a more closed canopy and are absent or at low densities in areas with open overstory (NatureServe 2012). The removal of most of the overstory to create ESF would have a negative impact on habitat suitability in cut stands. Local population densities would decline in the newly created ESF and remain low until canopy closure, in up to 20 years. Midstory treatments would also reduce the suitability of habitat, but may not eliminate it. Ovenbirds prefer a more open understory, but midstory removal followed by burning has been shown to cause population declines (ibid). Habitat would not be reduced by crop tree release because the overstory canopy would remain intact.

Under this alternative, approximately 655 acres of ovenbird habitat would be treated using herbicides, but only a portion of the acres treated would be directly impacted. The affected habitat would not be treated with herbicides until after cutting when habitat would no longer be suitable for ovenbirds. The herbicides proposed may come into contact with nesting birds and may be present on insects eaten. The herbicides used, however, are of low toxicity to birds (Tu et al 2001). The following factors would minimize the risk of contamination: 1) herbicides would be applied in small amounts; 2) specific methods of application such as thinline or stump treatments would limit exposure; 3) use of design criteria for herbicides, e.g. timing to avoid rainfall; and 4) birds are highly mobile and would leave the area during treatment, if they are not nesting.

Burning would occur in the spring before ovenbirds return for breeding season, so the species would be directly impacted. However, burning would decrease or eliminate the leaf litter layer impacting nesting habitat. Ovenbirds use leaf litter to construct their nests on the ground. Leaf litter would be less impacted on moist sites. Burning would create a more open understory, creating conditions favored by ovenbirds and would increase insect production and foraging quality. Approximately 1,057 acres would be burned, but fire generally burns in a mosaic pattern; leaving many moist areas untouched, so much of the ovenbirds habitat would be unaltered. Other proposed activities including nest/bat box and log installation, waterhole construction, and other road activities would have no effect on ovenbird.

Although ovenbird habitat would be reduced in the analysis area through the creation of ESF, 1,023 acres of deciduous forests would mature over the next 20 years, resulting in an increase in habitat. The amount of habitat available across the analysis area would remain abundant and would support the species' breeding requirements. The population in the analysis area would be expected to continue on its current positive trend.

Pileated woodpecker would be directly impacted by this alternative. Tree cutting, burning, and road construction during the breeding season may disrupt nesting behavior, but pileated woodpeckers are relatively tolerant of human disturbance around nest sites (Bull and Jackson 1995). Although snags would be protected from cutting, mortality of young may occur if a falling tree hits a nest tree. Burning of nest trees may cause mortality of young also. Because implementation would occur over time, and not all at once, impacts to the species would be short term. Impacts would be considered minor in context of the surrounding landscape where suitable habitat is abundant.

Nesting habitat would be impacted by creation of 335 acres of ESF. The decrease in canopy closure and the loss of most large live trees as a result of tree cutting would reduce the quality of nesting habitat (Bull and Jackson 1995). However, the implementation of RLRMP standards regarding snag retention and den trees would provide some protection. Thinning on 204 acres would favor retention of large mast producing trees, allowing more nesting habitat to remain. Remaining snags and den trees would continue to provide drumming and nest sites. The resulting damage to the trees left standing after harvest may create additional snags in the future, allowing for more nesting cavities and drumming sites. This species commonly forages in younger forests. Standing snags and logs left on the ground after harvest would increase areas for foraging.

Midstory treatments on 116 acres would have little impact on woodpecker habitat. Trees suitable for nesting would not be impacted, but smaller trees would die, creating new snags that may be used for foraging. Other proposed activities including crop tree release, nest/bat box and log installation, waterhole construction, and other road activities would have no effect on pileated woodpecker.

Under this alternative, approximately 655 acres of potential habitat would be treated using herbicides, but only a portion of the acres treated would be directly impacted. Herbicides proposed for treatments are unlikely to contact pileated woodpeckers directly but may be present on plants and insects eaten. The herbicides used, however, are of low toxicity to birds (Tu et al 2001). The following factors would minimize the risk of contamination: 1) herbicides would be applied in small amounts; 2) specific methods of application such as thinline or stump treatments would limit exposure; 3) use of design criteria for herbicides, e.g. timing to avoid rainfall; and 4) birds are highly mobile and would leave the area during treatment, if they are not nesting.

Approximately 1,057 acres would be burned. Prescribed fire generally burns in a mosaic pattern, with some areas burning completely while others little to none, particularly in moist coves. Although prescribed fire activities may eliminate some nesting trees, fire would also create new snags, providing additional nesting habitat. New snags are needed over time as old snags fall. New snags would also provide additional forage. Suitable habitat would remain within the burned area and habitat conditions would be improved.

The approximately 714 acres of mid-successional forest that would move into the late successional

stage over the next 20 years, along with an increase in snags created by insect infestations and disease, would increase habitat availability for pileated woodpecker. The population in the analysis area would be expected to continue on its current positive trend.

Scarlet tanager would be directly impacted by this alternative. Tree cutting and road construction during breeding season would disrupt nesting behavior. Studies indicate that scarlet tanagers abandon nest sites if logging occurs in occupied breeding habitat during nesting (Mowbray 1999). Felling of trees with nests would cause mortality of young. Because implementation would occur over time, and not all at once, impacts to the species would be short term. Impacts would be considered minor in context of the surrounding landscape where suitable habitat is abundant.

Breeding habitat suitability would be altered on the 325 acres of proposed ESF and 204 acres of thinning. Since some trees will remain in the harvested areas, tanagers may continue to nest there. Where they do not overlap with summer tanagers (as is the case in the analysis area), scarlet tanagers occupy more open habitat and are not restricted to dense canopy cover (Nicholson 1997). Scarlet tanagers may reoccupy harvested areas as early as 12 years after cutting if some small trees are left standing. They tolerate small or narrow clear-cuts, thinning, and selection cutting (NatureServe 2012).

Approximately 1,057 acres would be burned. Burning would occur in the spring before tanagers return for breeding season, so no birds would be directly impacted. Burning would not reduce the suitability of habitat and would increase insect production and foraging quality. Other proposed activities including nest/bat box and log installation, waterhole construction, and other road activities would have no effect on scarlet tanager.

The proposed midstory treatments on 116 acres and crop tree release on nine acres of OOPF would not reduce habitat suitability. ESF creation, thinning, midstory, and crop tree release would allow more sunlight into treated areas, increase insect production, and improve foraging habitat for the species.

Under this alternative, approximately 645 acres of scarlet tanager habitat would be treated using herbicides, but only a portion of the acres treated would be directly impacted. The affected areas would not be treated with herbicides until after harvest when habitat would no longer be as suitable for nesting. Therefore, the potential for impacts would be slight in those areas. Herbicides proposed for treatments are unlikely to contact scarlet tanagers directly because these birds stay high in the canopy away from herbicide applications. Herbicides may be present on plants and insects eaten. The herbicides used, however, are of low toxicity to birds (Tu et al 2001). The following factors would minimize the risk of contamination: 1) herbicides would be applied in small amounts; 2) specific methods of application such as thinline or stump treatments would limit exposure; 3) use of design criteria for herbicides, e.g. timing to avoid rainfall; and 4) birds are highly mobile and would leave the area during treatment, if they are not nesting.

Although scarlet tanager habitat would be reduced in the analysis area through the creation of ESF, 824 acres of OOPF would mature over the next 20 years, resulting in an increase in optimal habitat. The amount of habitat available across the analysis area would remain abundant and would support the species' breeding requirements. The alternative would not negatively influence the population trend in the analysis area.

Cumulative Effects for Alternative C

Alternative C would have a positive cumulative effect on *chestnut-sided warbler* habitat by increasing the amount of habitat for the species in the analysis area. Because no HESH has been created in the last 10 years, no past activities would be cumulative with the proposed creation of HESH. Small patches of HESH may be created by future prescribed burning and natural disturbances. By providing a shifting mosaic of HESH, this alternative would help lessen the negative population trend of chestnut-sided warbler in the analysis area and ensure its viability across the CNF.

Alternative C would have a positive cumulative effect on *prairie warbler* habitat by increasing the amount of habitat for the species in the analysis area. Because no low elevation ESF has been created in the last 10 years, no past activities would be cumulative with the proposed creation of 189 of ESF. Small patches of ESF habitat may be created by future prescribed burning and natural disturbances. By providing a shifting mosaic of low elevation ESF, this alternative would help lessen the negative population trend of prairie warbler in the analysis area and ensure its viability across the CNF.

Alternative C would have a slight adverse cumulative effect on *hooded warbler* habitat within the analysis area. Prescribed burning would not create canopy gaps due to the moist conditions in hooded warbler habitat. However, fire may consume the dense shrub layer that provides hooded warbler habitat in some areas. This would occur in patches across the burn, so habitat would remain available throughout. Suitable habitat would continue to be abundant and widespread. Hooded warbler populations would not likely decline. This alternative would not threaten the viability of hooded warbler across the CNF.

Alternative C would have an adverse cumulative effect on *ovenbird* within the analysis area. Prescribed burning would have short-term detrimental effects. Ovenbirds nest in areas with thick leaf litter and use leaves and small twigs to build nests on the ground. Fire would eliminate much of the nesting habitat in the burn areas, but leaf litter levels would recover within one to two years. Fire burns in a mosaic pattern, leaving patches of unburned leaf litter, so nesting habitat would remain scattered across the burn units. Ovenbirds would not be eliminated from burned areas, but densities would be reduced. Populations would return to previous levels within a few years after burning. The reduction of leaf litter would improve ground foraging conditions for this species, which has been found foraging in burned areas (Artman et al 2001). The past, proposed, and future activities combined would impact ovenbird habitat throughout the analysis area. Because the activities would occur over a long period and many of the impacts would be short term, habitat would remain abundant in the analysis area. Therefore populations would be unlikely to show a notable decline. This alternative would not threaten the viability of ovenbird across the CNF.

When combined with past and future thinning and burning, Alternative C would have a cumulative effect on *pileated woodpecker*. Additional habitat (snags and downed logs) would be created by implementation of this alternative and by future prescribed burning. Foraging habitat would be improved throughout the analysis area with the combination of these actions. Habitat would remain widely available in the analysis area. Population trends for pileated woodpecker would be expected to continue on a positive trend in the analysis area, and the species population would remain viable across the CNF.

Alternative C would have a slight adverse cumulative effect on *scarlet tanager* within the analysis area. Past and future prescribed burning would not destroy nesting habitat but may create small patches of ESF, which tanagers will tolerate (NatureServe 2012). Since the combined proposed timber harvest and past and future prescribed burns would impact but not eliminate scarlet tanager habitat throughout the analysis area, suitable habitat would continue to be abundant and widespread. Therefore, the species population would be unlikely to show a notable decline. This alternative would not threaten the viability of scarlet tanager across the CNF.

Demand Species

Alternative A (No Action)

Direct and Indirect Effects

Under Alternative A, *black bear* denning habitat would increase as the availability of late successional forests increased over time. Hard mast availability would increase over the next 20 years as SPF matured, benefiting the species through increased forage. Early successional habitat that provides spring and summer forage in the form of soft-mast, e.g. berries, would continue to be limited in the analysis area and would disappear over the next decade. Habitat diversity, especially for foraging, would decline as the landscape becomes further dominated by late successional forests. Any impacts to black bears from the absence of early successional foraging habitat would be negligible since the species would continue to find suitable forage within its large home range, particularly on private land. Overall, the bear population would remain stable or increase.

Ruffed grouse habitat would continue to decline over the next 20 years. Most of the SPF in the analysis area would be lost due to succession. SPF is essential to ruffed grouse for nesting and adult cover. ESF used for brood rearing habitat would continue restricted to small patches created by natural disturbances, fire, and along the edges of roads and spot openings.

Cumulative Effects

The No Action alternative would have no cumulative effects on *black bear* or *ruffed grouse* because any action would be deferred and would not be cumulative with other activities in the analysis area. Populations would continue on their current trends (see Table 3t).

Alternative B (Proposed Action)

Direct and Indirect Effects

Black bear would be directly impacted by this alternative. Bear activity and movement patterns would be altered during project implementation in order to avoid humans. However, bears are highly mobile and would continue to utilize the areas during and after implementation. Because implementation would occur over time, and not all at once, impacts to the species would be short term. Impacts would be considered minor in context of the surrounding landscape where suitable habitat is abundant.

Creation of ESF would alter denning habitat on 235 acres of late successional forests. Potential den trees would be protected from harvest according to RLRMP Standards, so impacts to denning habitat should be minor. Bears may also den in brush piles created from logging slash left after harvest. ESF creation would greatly reduce hard mast production areas in cut areas. Creation of

ESF and crop tree release would increase soft mast production and cover, providing habitat for feeding and loafing.

Habitat remoteness would be impacted during road construction, but the roads would be closed after use, so impacts would not last beyond implementation. Road maintenance would improve opportunities for hunting or viewing of this species by the public.

Under this alternative, approximately 383 acres of black bear foraging habitat would be treated using herbicides, but only a portion of the acres treated would be directly impacted. Herbicides proposed for treatments may contact bears directly as they travel through treated areas and may be present on food sources. The following factors would minimize the risk of contamination: 1) herbicides would be applied in small amounts; 2) specific methods of application such as thinline or stump treatments would limit exposure; 3) use of design criteria for herbicides, e.g. timing to avoid rainfall; and 4) bears are highly mobile and would leave the area during treatment if they are not denning.

Construction of two waterholes would provide water sources in drier areas. The construction of waterholes would create additional forage in the form of wetland plants, insects, and other animals. Other proposed activities including nest/bat box and log installation and road authorization would have no effect on black bear.

The 396 acres of vegetation management proposed in this alternative would increase the structural diversity in the area, as well as the variety of food sources and denning habitat. This would provide better year-round conditions because individuals would have less distance to travel and more habitats available for their seasonal requirements. During the spring and summer, bear activity may increase within the analysis area due to the enhancement and production of forage and an increase in habitat diversity. These activities would in turn improve hunting and wildlife viewing opportunities for the public. The black bear population trend would continue to be positive as a result of the alternative.

Ruffed grouse may be directly impacted only on a very small scale. Crop tree release implemented during breeding season would disrupt nesting behavior, potentially causing mortality of young in the nest. Mortality would be likely if trees with nests are cut or are crushed by fallen trees. Impacts would be short term and 13 acres of crop tree release would be considered minor in context of the surrounding landscape.

Currently, habitat for this species is scarce in the analysis area. Brooding, roosting, and feeding habitat would increase by 383 acres due to the proposed creation of ESF. Insect production would increase from the more open habitat conditions created by cutting in these areas. This would provide feeding and brood rearing habitat for the next 10 years. After the ESF matures to SPF, these areas would provide ideal hiding and breeding cover for ruffed grouse.

Under this alternative, approximately 383 acres of newly created ruffed grouse brood rearing habitat would be treated using herbicides, but only a portion of the acres treated would be directly impacted. The herbicides proposed may come into contact with nesting birds and may be present on insects eaten. The herbicides used, however, are of low toxicity to birds (Tu et al 2001). The following factors would minimize the risk of contamination: 1) herbicides would be applied in small amounts; 2) specific methods of application such as thinline or stump treatments would limit

exposure; 3) use of design criteria for herbicides, e.g. timing to avoid rainfall; and 4) birds are highly mobile and would leave the area during treatment, if they are not nesting.

Construction of waterholes would provide water sources in drier areas. Insect, plant, and seed production from the wetland edges of the waterholes would supply additional forage. Placement of drumming logs would enhance breeding habitat in harvested areas, providing places for males to display. Other proposed activities including crop tree release, nest/bat box installation, and road authorization would have no effect on ruffed grouse.

Improvements across the analysis area would provide brood rearing and foraging habitat that is currently missing. The alternative would also improve habitat conditions and diversity across the landscape and ensure the continuation of essential habitat requirements for grouse. These improvements would contribute to a local population increase. ESF creation would also ensure the continuation of ruffed grouse hunting and viewing opportunities.

Cumulative Effects for Alternative B

Alternative B would have a positive cumulative effect on *black bear*. Past and future prescribed burning would also improve habitat conditions. Burning would improve conditions for ground foraging and would increase sunlight, plant, and insect production. These activities combined would increase habitat diversity and food sources in the analysis area. By continuing to provide a diverse forested landscape, black bear populations would continue on their positive trends. This alternative would ensure the viability of these species across the CNF.

Alternative B would have a positive cumulative effect on the availability of *ruffed grouse*. Past and future prescribed burning would improve conditions for ground foraging by increasing sunlight, plant, and insect production. Burning may also create small patches of ESF. These activities combined would increase and maintain the amount of brood-rearing habitat and ensure the continuation of nesting habitat (SPF) over the long term in the analysis area. By maintaining and increasing the availability of quality habitat, this alternative would improve the negative population trend of ruffed grouse in the analysis area and ensure its viability across the CNF.

Alternative C

Direct and Indirect Effects

Black bear would be directly impacted by this alternative. Bear activity and movement patterns would be altered during project implementation in order to avoid humans. However, bears are highly mobile and would continue to utilize the areas during and after implementation. Because implementation would occur over time, and not all at once, impacts to the species would be short term. Impacts would be considered minor in context of the surrounding landscape where suitable habitat is abundant.

Creation of ESF and thinning would alter denning habitat on 509 acres of late successional forests. Potential den trees would be protected from harvest according to RLRMP Standards, so impacts to denning habitat should be minor. Bears may also den in brush piles created from logging slash left after harvest. ESF creation would greatly reduce hard mast production areas in cut areas. Large mast producing trees would be favored for retention in thinned stands. Creation of ESF, thinning, midstory, and crop tree release would increase soft mast production and cover, providing habitat

for feeding and loafing.

Habitat remoteness would be impacted during road construction, but the roads would be closed after use, so impacts would not last beyond implementation. Habitat remoteness would improve where Little Stony Creek Road would be decommissioned. Road maintenance would improve opportunities for hunting or viewing of this species by the public.

Under this alternative, approximately 655 acres of black bear foraging habitat would be treated using herbicides, but only a portion of the acres treated would be directly impacted. Herbicides proposed for treatments may contact bears directly as they travel through treated areas and may be present on food sources. The following factors would minimize the risk of contamination: 1) herbicides would be applied in small amounts; 2) specific methods of application such as thinline or stump treatments would limit exposure; 3) use of design criteria for herbicides, e.g. timing to avoid rainfall; and 4) bears are highly mobile and would leave the area during treatment if they are not denning.

Construction of waterholes would provide water sources in drier areas. The construction of waterholes would create additional forage in the form of wetland plants, insects, and other animals. Other proposed activities including nest/bat box and log installation and road authorization would have no effect on black bear.

Prescribed burning on 1,057 acres may directly impact black bears in the burn areas. Fire would cause bears to relocate if possible, but cubs may not be able to escape the fire, and may perish. However, the effects of burning on habitat would be beneficial. The 1,725 acres of vegetation management and burning proposed in this alternative would increase the structural diversity in the area, as well as the variety of food sources and denning habitat. This would provide better year-round conditions because individuals would have less distance to travel and more habitats available for their seasonal requirements. During the spring and summer, bear activity may increase within the analysis area due to the enhancement and production of forage and an increase in habitat diversity. These activities would in turn improve hunting and wildlife viewing opportunities for the public. The black bear population trend would continue to be positive as a result of the alternative.

Ruffed grouse may be directly impacted only on a very small scale. Crop tree release implemented during breeding season would disrupt nesting behavior, potentially causing mortality of young in the nest. Mortality would be likely if trees with nests are cut or are crushed by fallen trees. Impacts would be short term and 13 acres of crop tree release would be considered minor in context of the surrounding landscape.

Currently, habitat for this species is scarce in the analysis area. Brooding, roosting, and feeding habitat would increase by 383 acres due to the proposed creation of ESF. Insect production would increase from the more open habitat conditions created by cutting in these areas. This would provide feeding and brood rearing habitat for the next 10 years. After the ESF matures to SPF, these areas would provide ideal hiding and breeding cover for ruffed grouse.

Under this alternative, approximately 383 acres of newly created ruffed grouse brood rearing habitat would be treated using herbicides, but only a portion of the acres treated would be directly impacted. The herbicides proposed may come into contact with nesting birds and may be present

on insects eaten. The herbicides used, however, are of low toxicity to birds (Tu et al 2001). The following factors would minimize the risk of contamination: 1) herbicides would be applied in small amounts; 2) specific methods of application such as thinline or stump treatments would limit exposure; 3) use of design criteria for herbicides, e.g. timing to avoid rainfall; and 4) birds are highly mobile and would leave the area during treatment, if they are not nesting.

Construction of waterholes would provide water sources in drier areas. Insect, plant, and seed production from the wetland edges of the waterholes would supply additional forage. Placement of drumming logs would enhance breeding habitat in harvested areas, providing places for males to display. Other proposed activities including crop tree release, nest/bat box installation, and road authorization would have no effect on ruffed grouse.

Improvements across the analysis area would provide brood rearing and foraging habitat that is currently missing. The alternative would also improve habitat conditions and diversity across the landscape and ensure the continuation of essential habitat requirements for grouse. These improvements would contribute to a local population increase. ESF creation would also ensure the continuation of ruffed grouse hunting and viewing opportunities.

Cumulative Effects for Alternative C

Alternative C would have a positive cumulative effect on *black bear*. Past and future prescribed burning would also improve habitat conditions for these wildlife species. Burning would improve conditions for ground foraging and would increase sunlight, plant, and insect production. These activities combined would increase habitat diversity and food sources in the analysis area. By continuing to provide a diverse forested landscape, black bear populations would continue on their positive trends. This alternative would ensure the viability of these species across the CNF.

Alternative C would have a positive cumulative effect on the availability of *ruffed grouse*. Past and future prescribed burning would improve conditions for ground foraging by increasing sunlight, plant, and insect production. Burning may also create small patches of ESF. These activities combined would increase and maintain the amount of brood-rearing habitat and ensure the continuation of nesting habitat (SPF) over the long term in the analysis area. By maintaining and increasing the availability of quality habitat, this alternative would improve the negative population trend of ruffed grouse in the analysis area and ensure its viability across the CNF.

Rare Species

Alternative A (No Action)

Direct and Indirect Effects

Animals

Whip-poor-will breeding habitat and populations would decrease in the analysis area due to ESF to loss of most current SPF in the next 20 years. Suitable habitat for the species would be restricted to existing powerlines corridors.

Habitats for and populations of *common raven* and *Diana fritillary* would continue to decline over the next five years as forests mature to later successional stages, reducing habitat diversity.

Habitats for and populations of *Yonahlossee salamanders*, *gray*, *eastern small-footed*, and *Indiana bats*, *Blackburnian warbler*, *glossy supercoil*, *delicate and cupped vertigo*, and *bidentate dome* would not be impacted because the actions would be deferred. For most of these species, this alternative would have a beneficial impact due to an increase in the availability of snags (insects for forage, cavity/nesting sites) and large woody debris (cover) from dead and down logs over the long term.

Plants

Fraser's sedge, *Steele's Joe-pye-weed*, *Appalachian gentian*, *whiteleaf sunflower*, *Coville's rush*, *large round-leaved orchid*, *Roan Mountain rattlesnake root*, *American wintergreen*, *large-fruited snakeroot*, *painted trillium*, and *Carolina hemlock* have been documented in close proximity to roads, trails, power lines, and/or wildlife openings within the Stony Creek analysis area. Current management activities would continue under this alternative. Individuals along roads, trails, power line, and wildlife openings would continue to be periodically disturbed by use and maintenance activities. Trampling, disturbance, and loss of individuals would occur as a result of these activities. Competition from native and invasive species would also contribute to population fluctuations over time; however, extirpation of these species from the area would not be expected. These disturbances help create and maintain suitable habitat conditions allowing plants to occupy these locations. Maintenance and use activities have been ongoing for many years and species have adapted to this level of disturbance at these sites.

Summer sedge, *broadleaf sedge*, *spinulose shield fern*, *large whorled pogonia*, and *purple fringeless orchid* have not been documented in close proximity to roads, trails, power lines and wildlife openings within the Stony Creek analysis area. Therefore, these species would not be impacted by these ongoing management activities. However, some species may experience local population fluctuations due to changing habitat conditions due to succession, insect/disease outbreaks, or other natural disturbances over the next five year period. Individuals currently taking advantage of canopy gaps, limited competition, or previous silvicultural activities may experience some declines as forest succession decreases light, or increases competition within currently occupied habitat. Ongoing management activities and natural disturbances (storm damage, canopy gap creation) would continue to create opportunities for establishment.

For rare species that routinely utilize early successional habitat, suitable habitat would remain limited as no early successional forest habitat is created through management. This habitat is currently restricted to existing road corridors, wildlife openings, power line right-of ways, forest edges and naturally occurring gaps from storms, insects and disease, and tree mortality. Selection of Alternative A would continue to restrict this habitat within the Stony Creek project area, which may result in occurrences being lost within the analysis area. Species would continue to occur at lower frequencies until additional habitat is created through natural processes. This may occur over the next five years as mortality from Hemlock wooly adelgid continues to increase.

For species that generally prefer older stands, habitat availability would increase as stands continue to mature. Populations would fluctuate in response to changing conditions resulting from natural processes (succession, canopy gap creation, etc.). Ongoing management activities and natural disturbances (storm damage, canopy gap creation) would continue to create opportunities for establishment and maintain suitable habitat within the analysis area for all rare species present. Late successional species would continue to flourish, while early successional species would occur

at lower frequencies until additional early successional habitat is created through natural processes.

Cumulative Effects for Alternative A

Animals

The No Action alternative would have no cumulative effects on *Yonahlossee salamanders*, *gray*, *eastern small-footed*, and *Indiana bats*, *whip-poor-will*, *Blackburnian warbler*, *common raven*, *Diana fritillary*, *glossy supercoil*, *delicate* and *cupped vertigo*, and *bidentate dome* because any action would be deferred and would not be cumulative with other activities in the analysis area.

Plants

The No Action alternative would have no cumulative effects on *summer sedge*, *broadleaf sedge*, *Fraser's sedge*, *spinulose shield fern*, *Steele's Joe-pye-weed*, *Appalachian gentian*, *whiteleaf sunflower*, *large whorled pogonia*, *Coville's rush*, *large round-leaved orchid*, *purple fringeless orchid*, *Roan Mountain rattlesnake root*, *American wintergreen*, *large-fruited snakeroot*, *painted trillium*, and *Carolina hemlock* because no new actions would be implemented under this alternative. Future habitat conditions within the Stony Creek area would be the result of natural processes, ongoing activities, and past and future projects.

Alternative B (Proposed Action)

Direct and Indirect Effects

Animals

The herbicides proposed for ESF creation activities are unlikely to contact rare animal species directly, but may be present on food sources that are ingested (plants and insects). The herbicides used however, are of low toxicity to mammals and birds (Tu et al 2001) and present low risk to aquatic species (SERA). The impacts of herbicides on amphibians and reptiles are unknown. Although little to no information is available for herbicide toxicity to terrestrial snails, the herbicides used appear to be relatively non-toxic for invertebrates (Tu et al 2001 and SERA).

Under Alternative B, approximately 383 acres would be treated using herbicides, but only a portion of the acres treated would be directly impacted. The following factors would minimize the risk of contamination: 1) herbicide applied in small amounts; 2) specific methods of application such as thinline or stump treatments; 3) design criteria for herbicide use, e.g. timing to avoid rainfall.

Yonahlossee salamander would be directly impacted by this alternative. Individuals may be injured or destroyed during waterhole construction, road construction, tree felling, and skidding. These direct effects would be short-term, occurring only during the duration of the activities and on a small scale. Compliance with RLRMP standards, including the stream filter zones, would protect the many individuals from harm.

Negative and long-term indirect effects would occur in potential habitat. Habitat is scattered throughout the analysis area, and the majority of the populations would not be impacted. Negative and long-term indirect effects would occur on 264 acres of potential habitat (mature mesic deciduous forest). Creating ESH within coves would increase sunlight to the forest floor causing leaf litter dry-out and increased surface temperatures. This may cause salamanders to relocate to

more moist conditions in adjacent stands. Home ranges of salamanders tend to be very small, on the order of a few to a few dozen meters in diameter. Yet, on occasion, they may travel at least several hundred meters (NatureServe 2012), which would be outside of the affected area. Additional habitat would remain undisturbed in adjacent areas within an acceptable travel distance.

Over time, canopy cover would increase to more suitable conditions again and the salamanders should return to the area. Salamanders are known to recolonize a clear-cut over 4-15 years and reach pre-harvest levels in up to 20 years (Ash 1997). Riparian zones, leave areas, logging slash, and remaining LWD would provide protection within harvested areas. Over time, canopy cover would increase to more suitable conditions again. Although habitat would be reduced, 898 acres of mesic deciduous forests would mature in the next 20 years. Because of the abundance of habitat remaining after project implementation, the population would persist in the analysis area.

Crop tree release would still allow shaded conditions and would not affect habitat to any degree. Less than three acres of salamander habitat would be destroyed due to temporary road construction; negative impacts would be short term for temporary roads. Yonahlossee salamanders have frequently been observed using tunnels in road cuts on the CNF, so some benefits would be achieved for this species. Construction of waterholes would provide upland sources of water and potential habitat for these salamanders. Installation of wildlife logs would provide cover for salamanders. Nest/bat box installation and other road activities would not have any impacts on Yonahlossee salamanders.

Gray bat would not be directly affected. Habitat associated with caves would not be impacted because no caves are located within the project area. Hibernacula and maternity colony habitat would not be affected. Activities would occur during the day while bats are roosting in caves and are absent from the project area. Three stands proposed for harvest and two stands proposed for crop tree release are adjacent to small, streams that are typically choked with rhododendron or other vegetation. These streams would not be suitable foraging habitat for gray bat. Riparian zone restrictions (no harvest within 100 feet of perennial streams) and streamside buffer zones (no herbicide or ground disturbance) would protect foraging habitat from changes to vegetation and water quality. Other proposed activities including nest/bat box and log installation and other road activities would not occur in suitable habitat or create habitat, and would have no effect on bats.

Indiana bat is not likely to be directly impacted by this alternative. There are no known hibernacula on the CNF, no caves are present in the project area, and no Indiana bats have been found on the North End of the CNF. Should an Indiana bat roost site be discovered prior to and/or during project implementation, project activities would stop, and the CNF would again consult with the FWS.

The proposed project would indirectly affect Indiana bat by alteration of roosting and foraging habitat. Removal of trees during harvest and road construction would contribute to the loss of future roosting habitat. However, Indiana bats have adapted to these types of situations as roost trees are temporary in nature (Pers. Comm.: O'Keefe 2011). The 15-20 basal area per acre (BA) remaining after harvest would ensure that roosting habitat would continue to be available in harvested stands over the next five years. The RLRMP requires the largest trees with favorable conditions for roosting bats to be left. It also requires retention of all shagbark hickory trees (>6 inch diameter) and snags with exfoliating bark. New snags would develop from trees damaged

during harvest, creating roosting habitat in the future. Installation of bat boxes would also provide additional roosting habitat. The overall effect of these harvest activities would provide open patches of forest with standing snags for roosting. The open conditions would make roosting habitat more suitable by providing more sunlight to maintain warmer conditions in the roost.

Creation of early successional habitat and crop tree release would increase light intensity and herbaceous plant diversity for the next five to ten years. This would increase insect production and improve forage conditions for bats. Construction of vernal ponds would supply upland water sources and improve foraging conditions. Other proposed activities including drumming log installation and other road activities would not occur in suitable habitat or create habitat, and would have no effect on bats.

Eastern small-footed bat could be directly affected by this alternative. If individuals are present in during creation of ESH, the activities may disturb, injure, or cause direct mortality to bats roosting in trees that are cut or pushed over. Road construction across a talus slope in Compartment 68 could adversely impact individuals if a maternity roost is present and activities occur during summer months. Maternity roosts could be disturbed during harvesting activities in four stands with rocky habitats, causing adults to leave their roosts temporarily. These impacts would be short-term and most maternity roost habitat would be protected by designated leave areas.

The proposed project would indirectly affect Indiana bat by altering roosting and foraging habitat. Removal of trees during harvest and road construction would contribute to the loss of future roosting habitat (standing snags would be retained). The 15-20 basal area per acre (BA) remaining after harvest would ensure that roosting habitat would continue to be available in harvested stands over the next five years. The RLRMP requires the largest trees with favorable conditions for roosting bats to be left. It also requires retention of all shagbark hickory trees (>6 inch diameter) and snags with exfoliating bark. New snags would develop from trees damaged during harvest, creating roosting habitat in the future. Installation of bat boxes would also provide additional roosting habitat. The overall effect of these harvest activities would provide open patches of forest with standing snags for roosting. The open condition of these areas would make roosting habitat more suitable by providing more sunlight to maintain warmer conditions in the roost.

Creation of early successional habitat and crop tree release would increase light intensity and herbaceous plant diversity for the next five to ten years. This would increase insect production and improve forage conditions for bats. Construction of vernal ponds would supply upland water sources and improve foraging conditions. Other proposed activities including other road activities would not occur in suitable habitat or create habitat, and would have no effect on bats.

Common raven may be directly impacted. Individuals may be disturbed, injured or killed during creation of ESH and road construction, although most individuals would likely move from the area of disturbance. Because these birds nest on cliffs or in conifers at high elevations, nesting habitat would not be disturbed. Habitat diversity would improve over the next ten years with the proposed creation of 383 acres of early successional forests. Ravens are opportunistic feeders (NatureServe 2012) so foraging habitat would increase with the increase of habitat diversity across the landscape.

The creation of waterholes would provide additional water sources in areas where water is generally lacking. Open forest conditions, increased habitat diversity, and the improved conditions

for fruits, seeds, and small mammals would increase forage for ravens. Raven populations would persist in the area. Other proposed activities including nest/bat box and log installation and other road activities would have no effect on ravens.

Blackburnian warblers and their habitat may be directly impacted by this alternative. Creation of ESH and temporary road construction may disrupt nesting behavior and potentially cause mortality of young if they in the nest during implementation. Midstory treatments would be leave trees standing, so nesting would not be disrupted in those areas. Because harvesting would occur over time, and not all at once, impacts to the species would be short term and considered minor in context of the surrounding landscape.

The removal of most of the overstory during creation of ESH would have a negative impact on habitat suitability of late successional stands at high elevations. However, these activities would not occur in optimal habitat. Blackburnian warblers prefer coniferous or mixed forests that would not be impacted in this alternative. Local population densities would likely decline if present in the harvested areas and remain low until canopy closure, in approximately 20 years. Harvesting would reduce the amount of breeding habitat available on 116 acres, but the amount of habitat available across the project area would remain sufficient to support the species' breeding requirements. The population in the project area would be expected to continue on its current positive trend.

Other proposed activities including nest/bat box and log installation, waterhole construction, and other road activities would not occur in suitable habitat or create habitat, and would have no effect on Blackburnian warbler.

Whip-poor-will would not be directly impacted by harvesting because stands proposed for ESF are not suitable habitat. Currently, habitat for this species is scarce in the analysis area.

Foraging and nesting habitat would increase by the addition of 189 acres of low elevation ESF in the analysis area. Increased insect production from the more open habitat conditions would provide ideal feeding conditions for whip-poor-wills. Without naturally occurring fires, active management is necessary to create the ESF required and to maintain a mosaic of forests in different successional stages (NatureServe 2012). Creation of ESH and post-cutting treatments in these areas would ensure the continued existence of habitat and population increases in the analysis area.

The continued process of road maintenance would also provide opportunity for hunting or viewing of this species by the public. Waterholes would provide water sources in drier areas. These improvements of habitat across the analysis area would likely contribute to a local population increase. Other proposed activities including crop tree release, nest/bat box and log installation, waterhole construction, and other road activities would not occur in suitable habitat or create habitat, and would have no effect on whip-poor-will.

Diana fritillary adults and caterpillars may be impacted during creation of ESH. Road construction, tree felling, and skidding may damage or destroy caterpillars on the ground and/or adults roosting in trees. However, these direct effects would be short-term, occurring only during the duration of the activities and would be limited to the action areas. Because habitat is found in over half of the analysis area, the majority of the local populations would not be impacted.

Compliance with RLRMP standards, including the stream filter zones, would protect individuals in riparian areas from harm.

This alternative would indirectly affect caterpillar habitat. Creation of ESH in mature MDF would increase sunlight to the forest floor, decreasing conditions for the growth of violets, the primary food source (host plant) for the species. As the forest regenerated and post-harvest treatments thinned the re-growth, host plant habitat conditions would become more favorable within five years. However, conditions may not be optimal until the forest matured. Crop tree release would not alter habitat conditions for caterpillars or their host plant to any degree. Caterpillar habitat would be reduced by one percent across the analysis area. Breeding and caterpillar habitat would remain abundant (66 percent of CNF lands) in the analysis area.

The increased sunlight from the creation of ESH would be beneficial for nectaring adults by promoting the growth of flowering plants for five to ten years post-harvest. Crop tree release would still allow for shaded conditions, and may encourage flowering plant abundance and diversity for nectar gathering over time. The amount of adult foraging habitat would likely increase in the analysis area.

Less than one acre of caterpillar habitat would be destroyed due to temporary road construction; negative impacts would be short term. No other activities planned in this alternative would impact *Diana fritillaria*. A diverse forested landscape would ensure that the viability of this *Diana* population butterfly on the CNF.

Glossy supercoil, *delicate vertigo*, *cupped vertigo*, and *bidentate dome* may be directly impacted (relocated or crushed) during creation of ESH, road construction, and waterhole construction,, particularly during tree felling and moving soil with heavy equipment. Any direct effects would be short-term, occurring only during the duration of the activities and limited to the activity area. Individuals in underground retreats, at the base of trees, and under large logs would be protected from direct impacts. Compliance with RLRMP standards, including the stream filter zones, would protect individuals in riparian areas from harm. Habitat for the species is scattered throughout the analysis area, and the majority of the populations would not be impacted.

Negative and long-term indirect effects would occur in potential habitat. ESH creation would increase sunlight to the forest floor causing leaf litter to dry out, and increased surface temperatures. This may cause snails to relocate to more moist conditions in adjacent stands. However, snails are able to survive dry periods, sometimes for years (Burch and Pearce 1990). Habitat would remain in ESH in the form of underground retreats, slash piles, and logs. By protecting them from dry conditions and predators, refugia are the most important limiting factor for these animals (Burch and Pearce 1990). Over the years, canopy cover would increase to more suitable conditions, and the snails should return to the area. Crop tree release would still provide shaded conditions and would not affect habitat to any degree. Because of the abundance of habitat remaining after project implementation, snail populations would persist in the analysis area.

Less than three acres of habitat would be lost where temporary road construction occurs; negative impacts would be short term for temporary roads. Road maintenance would have some beneficial indirect effects; the addition of limestone gravel on the roads would provide an additional source of calcium for shell production (Burch and Pearce 1990). After implementation, the snails would

use the area again. Installation of wildlife logs would provide cover for these snails. Waterhole construction, nest box installation, and other road activities would not cause any impacts.

Plants

Under Alternative B, approximately 383 acres (3% of project area) would be treated using herbicides, but only a portion of the acres treated would be directly impacted. The herbicides proposed for shelterwood treatments are unlikely to contact rare plant species directly because:

- Specific methods would be used for application (thinline or stump treatments).
- Criteria for herbicide use are designed to minimize movement to non-target individuals.
- Leave areas have been established at many rare plant locations.

However, accidental contact (nozzle drip, leak or spill) could occur in rare circumstances that would result in individual losses at some sites. Trampling as a result of herbicide treatment could also result in injury or losses to some individuals in close proximity to target individuals.

Impacts from nest boxes, vernal ponds, and drumming logs are expected to be negligible because impact areas are small and no rare species are present where ground disturbing activities would occur. Most of these wildlife improvements occur in areas recently disturbed by road or silvicultural activities leaving little opportunity for rare species establishment.

Authorization of 8.2 miles of roads would have no direct effects on rare plant species. These roads are already present on the ground and in use. Habitat conditions are not expected to change as a result of this decision. *Whiteleaf sunflower* and *Steele's joe-pye-weed* are known to occur along the edge of one of these roads. Maintenance and use of this road results in some impacts (trampling, dislodging), but it also retains suitable habitat conditions at the site. Populations would remain, and fluctuate in response to habitat conditions and time from last disturbance.

No direct or indirect impacts would occur to *summer sedge*, *broadleaf sedge*, or *purple fringeless orchid* under Alternative B. Known occurrences of these plants either occur outside of treatment areas, or have been excluded from direct impacts through riparian buffers. Populations would not be impacted by implementation of Alternative B.

No direct impacts would occur to *Fraser's sedge*, *spinulose shield fern*, or *Carolina hemlock* under Alternative B. Known occurrences of this plant have been excluded from direct impacts through exclusions or being located outside of treatment areas. Indirect impacts that would occur as a result of treatment in adjacent areas include: minor changes in microsite conditions (light, moisture), plant competition, and opportunities to expand or colonize additional areas that have become favorable habitat as a result of treatment. Some population fluctuations would occur, but these species would remain within the analysis area.

Forest Sensitive Plant Species – Four documented Sensitive plant species, *Appalachian gentian*, *whiteleaf sunflower*, *Roan Mountain rattlesnake root*, and *Carolina hemlock* could incur impacts under this alternative. Impacts on *Carolina hemlock* and *whiteleaf sunflower* are described above.

Appalachian gentian was documented from three sites within the analysis area that have been proposed for shelterwood harvest under Alternative B. This plant is also known from ten other

sites within the analysis area which are not impacted under this alternative. Shelterwood harvest would result in the loss of some individuals. Individuals located within riparian areas, leave clumps or outside the stand boundary would be protected from direct impacts. Habitat conditions would be favorable for establishment within the treatment area following the project. Populations would be expected to increase after treatment for 2-5 years and then slowly decline as canopy cover is established. Plants would remain within the future stand where suitable habitat is present.

Roan Mountain rattlesnake root was documented from three sites within the analysis area that have been proposed for shelterwood harvest and temporary road construction under Alternative B. This plant is also known from four other sites within the analysis area which are not impacted under this alternative. Impacts from shelterwood harvest would be similar to those described for Appalachian gentian. The temporary road would be constructed on an existing trail corridor. Temporary road construction would result in the loss of some individuals. Habitat conditions would be favorable along road banks and road edges allowing for the population to recover and expand within suitable habitat. Populations would gradually fall towards previous levels following treatment as surrounding vegetation shades out the temporary road. Following implementation, the temporary road would revert back to a trail. Plants are expected to remain along the trail corridor where suitable habitat is present.

Other planned activities under Alternative B would not have direct impacts on Appalachian gentian or Roan Mountain rattlesnake root because they are not known to occur within these areas. These plants occur in a variety of habitat including road sides, forest and trail edges, and canopy gaps. Crop tree release, road maintenance, invasive species control, and temporary roads created for implementation would provide improved habitat conditions and opportunities for establishment within the analysis area. Shelterwood harvest and temporary road construction would have some initial negative impacts, but create suitable habitat conditions following implementation. Populations would fluctuate as a result of activities and habitat conditions, but individuals would remain within the analysis area.

Forest Viability Plant Species – Twelve viability plant species have been documented within the analysis area that could incur impacts under this alternative. Impacts on *summer sedge*, *broadleaf sedge*, *Fraser's Sedge*, *spinulose shield fern*, and *purple fringeless orchid* have been previously discussed under Alternative B.

Steele's Joe-pye weed was documented in eight areas proposed for shelterwood harvest (five areas), temporary road construction (two areas), and road authorization under this alternative. This plant is also known from nine other sites within the analysis area that are not impacted under this alternative. Shelterwood harvest would result in the loss of some individuals. Individuals located within riparian areas, leave clumps or outside the stand boundary would be protected from direct impacts. Habitat conditions would be favorable for establishment within the treatment area following the project. Populations would be expected to increase after treatment for 2-5 years and then slowly decline as canopy cover is established. Plants would remain within the future stand where suitable habitat is present.

Temporary road construction would result in the loss of some individuals. Habitat conditions would be favorable along road banks and road edges allowing for the population to recover and expand within suitable habitat. Populations would gradually fall towards previous levels following treatment as surrounding vegetation shades out the temporary road. One of the temporary roads

would be constructed on an existing trail. Following implementation, the temporary road would revert back to a trail. Plants are expected to remain along the trail corridor where suitable habitat is present.

Plants are known to occur along the edge of one road that would be authorized under Alternative B. This road is currently in use and authorization of the road would not lead to any changes in habitat conditions on the ground. Maintenance and use of this road results in some impacts (trampling, dislodging), but it also retains suitable habitat conditions at the site. Populations would remain, and fluctuate in response to habitat conditions and time from last disturbance.

Other planned activities under Alternative B would not have direct impacts on Steele's joe-pye-weed because it is not known to occur within these areas. This plant occurs in a variety of habitat including road sides, forest and trail edges, mesic forest, and canopy gaps. Crop tree release, road maintenance, invasive species control, and temporary roads created for implementation would provide improved habitat conditions and opportunities for establishment within the analysis area. Shelterwood harvest and temporary road construction would have some initial negative impacts, but create suitable habitat conditions following implementation. Populations would fluctuate as a result of activities and habitat conditions, but individuals would remain within the analysis area.

Large whorled pogonia was documented in two areas proposed for shelterwood harvest under Alternative B. It is also known from two other sites not impacted under this alternative. Implementation would result in impacts to the population. Impacts would include crushing, trampling, and decreasing habitat suitability by increasing sunlight and plant competition until canopy cover is reestablished. Initial population decreases should be expected. Leave areas would be established to protect some plants from direct impacts resulting from harvest. These plants would serve as the source population for recovery as habitat conditions improve over time as the regenerating stand matures. Populations would fluctuate as a result of available habitat conditions, but individuals would remain in the future stand.

Other planned activities under Alternative B would not have direct impacts on large whorled pogonia because it is not known to occur within these areas. This plant prefers open, mesic forest conditions and canopy gaps within these types of forests. Invasive species control would provide improved habitat conditions within the analysis area. Shelterwood harvest, crop tree release, and temporary road construction would have negative impacts on habitat availability until canopy cover is reestablished within these areas. Populations would fluctuate as a result of activities and habitat conditions, but individuals would remain within the analysis area.

Coville's rush was documented in one area proposed for shelterwood harvest under this alternative. Plants would be located within a riparian buffer and excluded from treatment. Given the proximity of the population to Griffith Branch road, there could be some impacts (crushing, dislodging) to the population as a result of road maintenance (brushy back edges, cleaning culverts, etc.). Maintenance keeps the area open and controls encroaching woody vegetation that could shade out this population. Actions would result in population fluctuations at the site, but individuals would remain throughout the project.

Other planned activities under Alternative B would not have direct impacts on Coville's rush because it is not known to occur within these areas. This plant prefers open, moist seeps, ditches, and springs that are protected by riparian buffers. Other planned activities would have little impact

on available habitat. Populations would fluctuate as a result of activities and habitat conditions, but individuals would remain within the analysis area.

Large round-leaved orchid was documented in three areas proposed for shelterwood harvest under Alternative B. It is also known from three other sites not impacted under this alternative. Only one individual was observed at each location proposed for treatment. Two of these sites have been excluded from treatment. Indirect effects (increased light, decreased moisture) would occur at one of these sites due to activities in the surrounding area. This may impact flowering rates or phenology, but is not expected to result in mortality. The individual at the third site is likely to be lost as a result of treatment.

Other planned activities under Alternative B would not have direct impacts on large round-leaved orchid because it is not known to occur within these areas. This plant prefers open, mesic forest conditions. Invasive species control would provide improved habitat conditions within the analysis area by reducing competing vegetation. Shelterwood harvest, crop tree release, and temporary road construction would have negative impacts on habitat availability until canopy cover is reestablished within these areas. Populations would fluctuate as a result of activities and habitat conditions, but individuals would remain within the analysis area. Large-round leaf orchid is known from at least 33 other sites on the north end of the Cherokee National Forest. Loss of one occurrence within the analysis area would not result in viability concerns for this species.

American wintergreen was documented in two areas proposed for shelterwood harvest and temporary road construction under Alternative B. It is also known from eight other sites not impacted under this alternative. Shelterwood harvest would result in the loss (crushed, trampled, covered by logging debris) of individuals within the treatment area. Areas with lower basal area (>30) would be less suitable for this plant than areas where more trees remain. Populations would fluctuate as a result of plant competition and habitat conditions following treatment and initial population declines should be expected. Individuals would remain within exclusions, leave clumps, and scattered locations within the stand. Conditions would improve as a new forest canopy is established (7-10 years) allowing recovery to occur in the area.

Temporary road construction would result in the loss of individuals during implementation. These individuals represent the eastern extent of a larger population, which would remain following construction. Recovery is expected along road edges, and flowering rates may increase as a result of increased light. Recovery may not occur within the road bed due to soil compaction. This would result in a slight population decrease in the area, but does not represent a viability threat to the species. Individuals would remain in the area and future populations would be determined by the habitat conditions present.

Other planned activities under Alternative B would not have direct impacts on American wintergreen because it is not known to occur within these areas. This plant prefers dry to mesic forest conditions, and bog edges. Invasive species control would provide improved habitat conditions within the analysis area by reducing competing vegetation. Shelterwood harvest, crop tree release, and temporary road construction would have negative impacts on habitat availability until canopy cover is reestablished within these areas. Populations would fluctuate as a result of activities and habitat conditions, but individuals would remain within the analysis area.

Large-fruited snakeroot was documented in one areas proposed for temporary road construction

under Alternative B. The temporary road would be constructed on an existing trail. Following implementation, the temporary road would revert back to a trail. Individuals located within the impact area would be lost during temporary road construction under Alternative B. Habitat conditions would be less favorable for individuals located along road banks and road edges following construction. Survival in these areas would be determined by moisture condition and plant competition. Conditions would improve as surrounding vegetation closes canopy gaps allowing some recovery to occur. Plants are expected to remain along the trail corridor where suitable habitat is present. Populations would fluctuate based upon conditions at the site.

Other planned activities under Alternative B would not have direct impacts on large-fruited snakeroot because it is not known to occur within these areas. This plant prefers mesic forest conditions. Invasive species control would provide improved habitat conditions within the analysis area by reducing competing vegetation. Shelterwood harvest, crop tree release, and temporary road construction would have negative impacts on habitat availability until canopy cover is reestablished within these areas. Populations would fluctuate as a result of activities and habitat conditions, but individuals would remain within the analysis area.

Painted trillium was documented in three areas proposed for shelterwood harvest under Alternative B. This plant is also known from one other site in the analysis area that would not be impacted by proposed activities. Individuals would be lost (crushed, trampled, covered by logging debris) during implementation. Areas with lower basal area (>30) would be less suitable for this plant than areas where more trees remain. Populations would fluctuate as a result of plant competition and habitat conditions following treatment and initial population declines should be expected. Individuals would remain within exclusions, leave clumps, and scattered locations within the stand. Conditions would improve as a new forest canopy is established (7-10 years) allowing recovery to occur in the area. Recovery would occur where microsite conditions (light, moisture, and plant competition) are favorable. Future populations in these stands would be determined by existing conditions, plant competition and recruitment.

Other planned activities under Alternative B would not have direct impacts on painted trillium because it is not known to occur within these areas. This plant prefers mesic forest conditions. Invasive species control would provide improved habitat conditions within the analysis area by reducing competing vegetation. Shelterwood harvest, crop tree release, and temporary road construction would have negative impacts on habitat availability until canopy cover is reestablished within these areas. Populations would fluctuate as a result of activities and habitat conditions, but individuals would remain within the analysis area.

Cumulative Effects for Alternative B

Animals

This alternative would have a positive cumulative effect on *Diana fritillary*. Past and future burning when combined with the ESF proposed under Alternative B would improve the species' foraging habitat and increase habitat diversity in the analysis area. By continuing to provide a diverse forested landscape, this alternative would have a positive cumulative impact on the species' populations in the analysis area.

Alternative B would have an adverse cumulative effect on *Yonahlossee salamander*, *glossy supercoil*, *delicate vertigo*, *cupped vertigo*, and *bidentate dome*. Combined with past and future

burning activities, this alternative would have a negative cumulative effect on these species. Past and future burning and proposed ESH in the analysis area would decrease suitable habitat due to the loss of shading, the increased sunlight and elevated temperatures on the forest floor and from the loss of future large woody debris (cover). Suitable habitat would continue to be widespread and abundant however throughout the analysis area, and the species' populations would not be likely to decline measurably.

Alternative B would have no cumulative effects on *gray bat* because activities would not occur in these species habitats.

This alternative, combined with past and future burning would have a positive cumulative effect on *Eastern small-footed bat* and *Indiana bat* because snags would be created by all of these activities. The cumulative effect of these activities would be a more open and diverse forest with abundant snags. Additional habitat would be created by natural disturbances, such as wind storms and ice/snow damage, and insect/disease outbreaks. By continuing to protect and provide an abundance of snags, populations of these species would not decline as a result of any of this alternative.

No cumulative effects would occur for *Blackburnian warbler* within the analysis area. No measurable effects to Blackburnian warbler populations or habitat from past or future prescribed burning would occur. Fire would be at a low intensity in suitable habitat and would occur before birds arrive for the breeding season.

Alternative B would have a positive cumulative effect on *whip-poor-will* habitat by increasing the amount of habitat for the species in the analysis area. No harvesting at lower elevations over the last 10 years would be cumulative with the proposed creation of 93 acres of low elevation ESF. Small patches of habitat may be created by prescribed burning and natural disturbances. By continuing to provide availability shifting mosaic of low elevation ESF, this alternative would help lessen the negative population trend of whip-poor-will in the analysis area and ensure the species' viability across the CNF.

Plants

Prescribed burning in the last five years, combined with future burning, ongoing maintenance, and implementation of activities under Alternative B would increase habitat diversity within the analysis area. Actions result in population fluctuations, but create and maintain suitable habitat conditions that can be occupied by a wide variety of plant species. This alternative reestablishes an early successional forest component on 383 acres of the landscape that has declined in recent years through succession into sapling/pole forest. Actions would reduce and modify mid- and late successional forest and improve suitability for species that prefer early forest conditions. Implementation would result in a mosaic distribution of habitats within the landscape. The cumulative impact of past and future actions would create a variety of early, mid, and late successional forest on the landscape providing suitable habitat for rare species in the area.

Cumulative impacts associated with maintenance activities (trail, road, wildlife, etc.) have been incorporated in the direct and indirect effects analysis due to the ongoing nature of these projects. Therefore, only cumulative effects associated with prescribed burning will be discussed in this section (see Table 3r).

Known populations of *summer sedge*, *broadleaf sedge* and *purple fringeless orchid* would not be directly or indirectly impacted under Alternative B. Therefore, no cumulative impacts are expected.

No cumulative effects are expected on *Fraser's sedge* or *Coville's rush*. These plants occur in areas with very high moisture conditions (generally in or near water) that would not be impacted by dormant season burns.

This alternative, combined with past and future burning would have a positive cumulative effect on *Steele's Joe-pye-weed*, *Appalachian Gentian*, *whiteleaf sunflower*, and *Roan Mountain rattlesnake root*. *Steele's Joe-pye-weed*, *Appalachian Gentian* and *Roan Mountain rattlesnake root* are known to occur within the burn areas. Dormant season burns are not expected to directly impact individuals, but would reduce woody competition within these areas. This would improve habitat conditions by reducing plant competition from woody plants in the understory and midstory. Increase light resulting from reduced plant competition would improve flowering rates where suitable habitat is present. Establishment could occur in areas where herbaceous plant competition is low to moderate. Future burning of this area would maintain suitable habitat conditions for these species within this project area.

Cumulative impacts are expected for *spinulose shield fern*, *large whorled pogonia*, *large round-leaved orchid*, *large-fruited snakeroot*, and *painted trillium*. Some impacts are expected to these species under Alternative B. All of these species except spinulose shield fern are known to occur within prescribed burn areas within the analysis area. Past and future dormant season burns would not result in direct impacts to individuals, but it would modify habitat conditions for these species in the analysis area. Prescribed burning would alter light and moisture conditions and create more open forest conditions by reducing woody competition in the midstory and understory layer. Population expansion would be expected in areas where light and moisture conditions remain suitable, but some declines may occur where conditions become too dry. Populations of these species would fluctuate in response to available habitat conditions.

Cumulative impacts are expected for *American wintergreen* and *Carolina hemlock*. Some impacts are expected to these species under Alternative B. Both of these species are known to occur within prescribed burn areas within the analysis area. Past and future dormant season burns would result in direct impacts to individuals such as burning of leaves and lower branches. Some mortality is also possible. Both of these species occur in dry habitats with a history of fire. Although direct impacts would occur, both species are capable of recovering from impacts. Therefore, cumulative impacts on these species are expected to be negligible. Populations would fluctuate slightly (either positively or negatively) based upon available post-burn conditions.

Management actions proposed under Alternative B, and past and future actions occurring on Forest Service lands are consistent with the RLRMP, and would ensure that suitable habitat remains for rare species within the Cherokee National Forest.

Alternative C

Direct and Indirect Effects

Animals

The herbicides proposed for ESF creation and thinning activities are unlikely to contact rare animal species directly, but may be present on food sources that are ingested (plants and insects). The herbicides, however, are of low toxicity to mammals and birds (Tu et al 2001) and present low risk to aquatic species (SERA). The impacts of herbicides on amphibians and reptiles are unknown. Although little to no information is available for herbicide toxicity to terrestrial snails, the herbicides used appear to be relatively non-toxic for invertebrates (Tu et al 2001 and SERA).

Under Alternative C, approximately 655 acres would be treated using herbicides, but only a portion of the acres treated would be directly impacted. The following factors minimize the risk of contamination: 1) herbicide applied in small amounts; 2) specific methods of application such as thinline or stump treatments; 3) design criteria for herbicide use, e.g. timing to avoid rainfall.

Yonahlossee salamander would be directly impacted by this alternative. Individuals may be injured or destroyed during burning, waterhole construction, road construction, tree felling, and skidding. These direct effects would be short-term, occurring only during the duration of the activities and on a small scale. Compliance with RLRMP standards, including the stream filter zones, would protect the many individuals from harm.

Negative and long-term indirect effects would occur in potential habitat. Habitat is scattered throughout the analysis area, and the majority of the populations would not be impacted. Negative and long-term indirect effects would occur on 486 acres of potential habitat (mature mesic deciduous forest). Creating ESH within coves would increase sunlight to the forest floor causing leaf litter dry-out and increased surface temperatures. This may cause salamanders to relocate to more moist conditions in adjacent stands. Home ranges of salamanders tend to be very small, on the order of a few to a few dozen meters in diameter. Yet, on occasion, they may travel at least several hundred meters (NatureServe 2012), which would be outside of the affected area. Additional habitat would remain undisturbed in adjacent areas within an acceptable travel distance.

Over time, canopy cover would increase to more suitable conditions again and the salamanders should return to the area. Salamanders are known to recolonize a clear-cut over 4-15 years and reach pre-harvest levels in up to 20 years (Ash 1997). Riparian zones, leave areas, logging slash, and remaining LWD would provide protection within harvested areas. Although habitat would be reduced, 898 acres of mesic deciduous forests would mature in the next 20 years. Because of the abundance of habitat remaining after project implementation, the population would persist in the analysis area.

Thinning would have less of an impact on snail habitat than shelterwood harvest because a more shaded conditions would remain in the thinned stands. Crop tree release and midstory treatments would still allow shaded conditions and would not affect habitat to any degree.

Less than three acres of salamander habitat would be destroyed due to temporary road construction; negative impacts would be short term for temporary roads. Yonahlossee salamanders have frequently been observed using tunnels in road cuts on the CNF, so some benefits would be

achieved for this species. Construction of waterholes would provide upland sources of water and potential habitat for these salamanders. Installation of wildlife logs would provide cover for salamanders. Road recontouring would provide additional habitat. Nest/bat box installation, wildlife opening creation, and other road activities would not have any impacts on Yonahlossee salamanders.

Gray bat would not be directly affected. Habitat associated with caves would not be impacted because no caves are located within the project area. Hibernacula and maternity colony habitat would not be affected. Activities would occur during the day while bats are roosting in caves and are absent from the project area.

Four early successional, the thinning and two crop tree release stands are adjacent to small, streams that are typically choked with rhododendron or other vegetation. These streams would not be suitable foraging habitat for gray bat. Riparian zone restrictions (no harvest within 100 feet of perennial streams) and streamside buffer zones (no herbicide or ground disturbance) would protect foraging habitat from changes to vegetation and water quality. Harvest in other stands would have no indirect effects on gray bat. Road decommissioning, obliteration, recontouring, and trail relocation, would improve water quality along Little Stony Creek where gray bats may forage. Road maintenance and authorization, crop tree release, and grouse drumming log installation would have no effect on gray bat.

Indiana bat is not likely to be directly impacted by this alternative. There are no known hibernacula on the CNF, no caves are present in the project area, and no Indiana bats have been found on the North End of the CNF. Should an Indiana bat roost site be discovered prior to and/or during project implementation, project activities would stop, and the CNF would again consult with the FWS.

The proposed project would indirectly affect Indiana bat by alteration of roosting and foraging habitat. Removal of trees during harvest, temporary road construction, trail construction, and road obliteration/recontouring would contribute to the loss of future roosting habitat. However, Indiana bats have adapted to these types of situations as roost trees are temporary in nature (Pers. Comm.: O'Keefe 2011). The 15-20 basal area per acre (BA) remaining in early successional areas and 35-60 BA in the thinned area would ensure that roosting habitat would continue to be available in harvested stands over the next five years. The RLRMP requires the largest trees with favorable conditions for roosting bats to be left. It also requires retention of all shagbark hickory trees (>6 inch diameter) and snags with exfoliating bark. New snags would develop from trees damaged during harvest, creating future roosting habitat. Installation of bat boxes would also provide additional roosting habitat. The overall effect of the harvest activities would provide open patches of forest with standing snags for roosting. The open condition of the areas would make roosting habitat more suitable by providing more sunlight to maintain warmer conditions in the roost.

Creation of early successional habitat, thinning, midstory, and crop tree release would increase light intensity and herbaceous plant diversity for the next five to ten years. Conversion of a temporary road and log landing to a wildlife opening would increase open conditions, plant diversity, and create travel corridors. These activities would increase insect production and improve forage conditions for bats. Construction of vernal ponds would supply upland water sources and improve foraging conditions. Crop tree release, road maintenance, authorization, and

decommissioning, trail relocation, and grouse drumming log installation would have no effect on Indiana bat.

Eastern small-footed bat could be directly affected by this alternative. If individuals are present in treatment areas during creation of ESFH and thinning, the activities may disturb, injure, or cause direct mortality to bats roosting in trees that are cut or pushed over. Road construction across a talus slope in Compartment 68 could adversely impact individuals if a maternity roost is present and activities occur during summer months. Maternity roosts could be disturbed during harvesting activities in four stands with rocky habitats, causing adults to leave their roosts temporarily. Any impacts would be short term and most maternity roost habitat would be protected by designated leave areas.

The proposed project would indirectly affect Eastern small-footed bat by alteration of roosting and foraging habitat. Removal of trees during harvest, temporary road construction, trail construction, and road obliteration/recontouring would contribute to the loss of future roosting habitat (standing snags would be retained). The 15-20 basal area per acre (BA) remaining in early successional areas and 35-60 BA in the thinned area would ensure that roosting habitat would continue to be available in harvested stands over the next five years. The RLRMP requires the largest trees with favorable conditions for roosting bats to be left. It also requires retention of all shagbark hickory trees (>6 inch diameter) and snags with exfoliating bark. New snags would develop from trees damaged during harvest, creating roosting habitat in the future. Installation of bat boxes would also provide additional roosting habitat. The overall effect of these harvest activities would provide open patches of forest with standing snags for roosting. The open condition of these areas would make roosting habitat more suitable by providing more sunlight to maintain warmer conditions in the roost.

Creation of early successional habitat, thinning, midstory, and crop tree release would increase light intensity and herbaceous plant diversity for the next five to ten years. Conversion of a temporary road and log landing to a wildlife opening would increase open conditions, plant diversity, and create travel corridors. These activities would increase insect production and improve forage conditions for bats. The creation of wildlife openings would provide a permanent source for quality foraging areas. Construction of vernal ponds would supply upland water sources and improve foraging conditions. Crop tree release, road maintenance, authorization, and decommissioning, trail relocation, and grouse drumming log installation would have no impact on Eastern small-footed bats.

Common raven may be directly impacted. Individuals may be disturbed or injured during burning, creation of ESH, thinning, and road construction, although most individuals would likely move from the area of disturbance. Because these birds nest on cliffs or in conifers at high elevations, nesting habitat would not be disturbed. Thinning, ESH creation, wildlife opening creation, midstory treatments, burning, and crop tree release would improve habitat diversity over the next ten years. Ravens are opportunistic feeders (NatureServe 2012) so foraging habitat would increase with the increase of habitat diversity across the landscape.

The creation of waterholes would provide additional water sources in areas where water is generally lacking. Open forest conditions, increased habitat diversity, and the improved conditions for fruits, seeds, and small mammals would increase forage for ravens. Raven populations would

persist in the area. Other proposed activities including nest/bat box and log installation and other road and trail activities would have no effect on ravens.

Blackburnian warblers and their habitat may be directly impacted by this alternative. Creation of ESH and temporary road construction may disrupt nesting behavior and potentially cause mortality of young if they in the nest during implementation. Midstory treatments would leave trees standing, so nesting would not be disrupted in those areas. Because harvesting would occur over time, and not all at once, impacts to the species would be short term and considered minor in context of the surrounding landscape.

The removal of most of the overstory during creation of ESH would have a negative impact on habitat suitability of late successional stands at high elevations. However, these activities would not occur in optimal habitat. Blackburnian warblers prefer coniferous or mixed forests that would not be impacted in this alternative. Local population densities would likely decline if present in the harvested areas and remain low until canopy closure, in approximately 20 years. Harvesting would reduce the amount of breeding habitat available on 116 acres, but the amount of habitat available across the project area would remain sufficient to support the species' breeding requirements. The population in the project area would be expected to continue on its current positive trend.

Burning in the Griffith Branch area would occur in the spring before warblers return for breeding season, so no birds would be directly impacted. Burning would take place in predominately hardwood forest, not in optimal Blackburnian warbler habitat. Burning would not reduce the suitability of habitat and would increase insect production and foraging quality. Other proposed activities including crop tree release, thinning, nest/bat box and log installation, waterhole construction, and other road activities would not occur in suitable habitat or create habitat, and would have no effect on Blackburnian warbler.

Whip-poor-will would not be directly impacted by harvesting because stands proposed for ESF are not suitable habitat. Currently, habitat for this species is scarce in the analysis area. Foraging and nesting habitat would increase by the creation of 218 acres of low elevation ESF and 204 acres of thinning in the analysis area. Increased insect production from the more open habitat conditions would provide ideal feeding conditions for whip-poor-wills. Without naturally occurring fires, active management is necessary to create the ESF required and to maintain a mosaic of forests in different successional stages (NatureServe 2012). Creation of ESH and post-cutting treatments in these areas would ensure the continued existence of habitat and population increases in the analysis area.

Burning in the Weaver Branch Burn area would occur in the spring before whip-poor-wills return for breeding season. No birds or existing habitat would be impacted. However, if small pockets of trees are burned to create openings, additional habitat may be created. Burning may also increase insect production and improve foraging conditions.

Waterholes would provide water sources in drier areas. These improvements of habitat across the analysis area would likely contribute to a local population increase. Other proposed activities including crop tree release, midstory treatments, nest/bat box and log installation, waterhole construction, and other road activities would not occur in suitable habitat or create habitat, and would have no effect on whip-poor-will.

Diana fritillary adults and caterpillars may be impacted during creation of ESH. Road construction, burning, tree felling, and skidding may damage or destroy caterpillars on the ground and/or adults roosting in trees. However, these direct effects would be short-term, occurring only during the duration of the activities and would be limited to the action areas. Because habitat is found in over half of the analysis area, the majority of the local populations would not be impacted. Compliance with RLRMP standards, including the stream filter zones, would protect individuals in riparian areas from harm.

This alternative would indirectly affect caterpillar habitat. Creation of ESH and thinning in mature MDF would increase sunlight to the forest floor, decreasing conditions for the growth of violets, the primary food source (host plant) for the species. As the forest regenerated and post-harvest treatments thinned the re-growth, host plant habitat conditions would become more favorable within five years. However, conditions may not be optimal until the forest matured. Crop tree release would not alter habitat conditions for caterpillars or their host plant to any degree. Caterpillar habitat would be reduced by less than one percent across the analysis area. Breeding and caterpillar habitat would remain abundant (66 percent of CNF lands) in the analysis area.

The increased sunlight from the creation of ESH and thinning would be beneficial for nectaring adults by promoting the growth of flowering plants for five to ten years post-harvest. Crop tree release and midstory treatments would still allow for shaded conditions, and may encourage flowering plant abundance and diversity for nectar gathering over time. The amount of adult foraging habitat would likely increase in the analysis area.

Diana larvae would be hibernating in the moist cove forests when burning is implemented. Fire generally burns in a mosaic pattern leaving patches of cove forests untouched (Sellers 2009). Larvae in cove forests could be directly impacted by burning. The remaining individuals within and adjacent to the burned areas would repopulate the area over time, but it is not known how long that would take. Although burning would have negative direct effects, it would also have beneficial indirect effects. In some areas more open conditions would be created, making conditions more suitable for *Diana* breeding habitat. Burning would also improve foraging habitat for adult *Diana*'s by increasing light conditions and flower production (NatureServe 2012). These impacts would be short-term and the population would persist in the area.

Less than one acre of caterpillar habitat would be destroyed due to temporary road construction; negative impacts would be short term. Wildlife opening creation would have some beneficial indirect effects to adults, by providing additional nectaring areas in the future. Road maintenance, authorization, and decommissioning, trail relocation, waterhole construction, and grouse drumming log installation would have no impact on *Diana*'s. A diverse forested landscape would ensure that the viability of this *Diana* population butterfly on the CNF.

Glossy supercoil, *delicate vertigo*, *cupped vertigo*, and *bidentate dome* may be directly impacted (relocated or crushed) during creation of ESH, thinning, road construction, and waterhole construction, particularly during tree felling and moving soil with heavy equipment. Any direct effects would be short-term, occurring only during the duration of the activities and limited to the activity area. Individuals in underground retreats, at the base of trees, and under large logs would be protected from direct impacts. Compliance with RLRMP standards, including the stream filter zones, would protect individuals in riparian areas from harm. Habitat for the species is scattered throughout the analysis area, and the majority of the populations would not be impacted.

Negative and long-term indirect effects would occur in potential habitat. ESH creation would increase sunlight to the forest floor causing leaf litter to dry out, and increased surface temperatures. This may cause snails to relocate to more moist conditions in adjacent stands. However, snails are able to survive dry periods, sometimes for years (Burch and Pearce 1990). Habitat would remain in ESH in the form of underground retreats, slash piles, and logs. By protecting them from dry conditions and predators, refugia are the most important limiting factor for these animals (Burch and Pearce 1990). Over the years, canopy cover would increase to more suitable conditions, and the snails should return to the area.

Thinning would have less of an impact on snail habitat than shelterwood harvest because a more shaded conditions would remain in the thinned stands. Midstory treatments and crop tree release would still provide shaded conditions and would not affect habitat to any degree. Because of the abundance of habitat remaining after project implementation, snail populations would persist in the analysis area.

Fireline construction may directly impact any snails present. Some may be crushed, but others would be able to relocate. Snails are most abundant in the humus layer, leaf litter, rocks, and wood on the forest floor (Burch 1990). Because these species occur within leaf litter, some mortality could occur as a result of the burning. However, during dry periods (suitable for burning) most would remain in the humus or the moist bottom layer of the leaf litter (Royal BC Museum 2006) or under logs and rocks. Fire generally burns in a mosaic pattern; leaving patches of the cove forests untouched (Sellers 2009). Moist leaf litter generally does not burn and fire does not consume the majority of large woody debris, so refuge such as large logs and rocks would remain. These refuges are the most important habitat component and the main limiting factor for their success. If individuals are lost, remaining ones would be capable of repopulating as they are hermaphrodites and can fertilize themselves (Burch 1990).

Snails are not able to move quickly or over much distance, and do not generally move around except to find food and for reproduction (NatureServe 2012). Where complete burning of the leaf litter does take place, habitat conditions would temporarily become unfavorable. The loss of their protective cover would result in movements to unburned areas, exposing snails to predation. The unburned patches would continue to provide habitat within the affected areas. Another layer of leaf litter would return the next autumn. Burning does not greatly reduce snail diversity (Royal BC Museum 2006), and small snails such as these have been found in previously burned areas on the CNF. These impacts would be short-term and populations would persist in the area.

Less than three acres of habitat would be lost where temporary road construction occurs; negative impacts would be short term for temporary roads. Road maintenance would have some beneficial indirect effects; the addition of limestone gravel on the roads would provide an additional source of calcium for shell production (Burch and Pearce 1990). After implementation, the snails would use the area again. Installation of wildlife logs would provide cover for these snails. Waterhole construction, nest box installation, and other road activities would not cause any impacts.

Plants

The effects to rare species would be the same as for Alternative B. Only the size and magnitude of the effects for the same activities would differ, so only the changes will be discussed.

Direct and indirect impacts for *whiteleaf sunflower*, *Colville's rush*, *large round-leaved orchid*, *purple fringeless orchid*, and *large-fruited snakeroot* would be the same as Alternative B. Despite differences in the alternatives, no additional known populations would be impacted under this alternative.

Forest Sensitive Plant Species – Four Sensitive plant species, *Appalachian gentian*, *whiteleaf sunflower*, *Roan Mountain rattlesnake root*, and *Carolina hemlock* have been documented that would incur impacts under this alternative. Impacts on *whiteleaf sunflower* are the same as Alternative B.

Appalachian gentian was documented from five sites within the analysis area that have been proposed for shelterwood harvest, a multi-use trail connector, and road decommissioning and trail work at Little Stony Road under Alternative C. This plant is also known from eight other sites within the analysis area which are not impacted under this alternative. Impacts from shelterwood harvest and road authorization are the same as Alternative B. Construction of the multi-use trail and activities at Little Stony Road would result in the loss of some individuals at these sites. Following implementation, suitable habitat would remain at both of these sites. Individuals adjacent to the impact area would recolonize these sites and trail maintenance activities would ensure that suitable habitat remains at the site. Appalachian Gentian is not known to occur within the thinning, midstory, wildlife openings, or burn areas, but these activities would provide favorable habitat conditions for establishment following treatment. Impacts from the parking area, vernal ponds, and wildlife boxes are negligible. Implementation of Alternative C would result in some impacts, but maintain suitable habitat conditions for this species. Populations would fluctuate as a result of activities and available habitat conditions, but individuals would remain in the analysis area.

Roan Mountain rattlesnake root was documented from four sites within the analysis area that have been proposed for shelterwood harvest, temporary road construction, prescribed burning, road decommissioning and trail work at Little Stony Road under Alternative C. This plant is also known from three other sites within the analysis area which are not impacted under this alternative. Impacts from shelterwood harvest and temporary road construction were described under Alternative B. Plants located within the Griffith Branch burn would not be directly impacted as plants would be dormant when burning takes place. Burning would remove competing woody vegetation and increase light providing favorable conditions for this plant. Impacts from other activities associated with Alternative C would be similar to those described for Appalachian gentian. Implementation of Alternative C would result in some impacts, but maintain suitable habitat conditions for this species. Populations would fluctuate as a result of activities and available habitat conditions, but individuals would remain in the analysis area.

Carolina Hemlock would incur some direct impacts associated with the Griffith Branch burn under Alternative C. One small sapling is located within the burn area. Implementation would result in the burning of needles and branches on the lower portion of this plant. Given the small size of the plant and presence of Hemlock Woolly Adelgid in the area, mortality is possible as a result of the burn, the disease, or the cumulative impact of both. Other known occurrences of Carolina hemlock would not be impacted by other activities associated with Alternative C. Populations would fluctuate as a result of activities and available habitat conditions, but individuals would remain in the analysis area.

Forest Viability Plant Species – Twelve viability plant species have been documented within the analysis area that would incur impacts under this alternative. Direct and indirect impacts for *Colville's rush*, *large round-leaved orchid*, *purple fringeless orchid*, and *large-fruited snakeroot* would be the same as Alternative B. Despite differences in these alternatives, no additional known populations would be impacted under this alternative. Available habitat conditions would change as a result of implementation, but suitable habitat and populations would remain within the analysis area.

Summer sedge would be impacted under Alternative C. Plants were documented within the thinning, which is also located in the Weaver Branch Burn area. Implementation would result in impacts to the some individuals within the population. Impacts would include crushing, trampling, and decreasing habitat suitability by increasing sunlight and plant competition. Direct impacts are not expected from the prescribed burn as plants would be dormant when the burn is implemented. Habitat conditions would be less suitable following treatment, which would result in a population decline within marginal habitat. Individuals would remain in the area where suitable habitat is present (riparian areas, leave clumps, etc.) and recovery would occur as conditions improve (canopy responds to treatment). Direct impacts from other activities associated with Alternative C are not expected as this plant is not known to occur within these areas. Populations would fluctuate as a result of activities and available habitat conditions, but individuals would remain in the analysis area.

Broadleaf sedge was documented from two sites within the analysis area. One site is proposed for shelterwood harvest, and the other site is proposed for thinning and prescribed burning. Impacts from thinning and prescribed burning would be the same as those described for summer sedge. One individual was found within the shelterwood area and this individual would likely be lost during implementation. Broadleaf sedge is associated with rich, moist deciduous forests (Flora of North America 2002). Habitat conditions within the shelterwood would be poor to marginal following treatment until canopy cover is reestablished. Reestablishment within the area could occur if individuals are present in adjacent areas. Direct impacts from other activities associated with Alternative C are not expected as this plant is not known to occur within these areas. Populations would fluctuate as a result of activities and available habitat conditions, but individuals would remain in the analysis area.

Fraser's sedge would not be directly impacted under Alternative C, but indirect impacts could occur to one additional population. Plants occur where road decommissioning and trail work would occur on Little Stony Road. Plants are protected from direct impacts, but work would provide opportunities for this population to expand following treatment. Direct impacts from other activities associated with Alternative C are not expected as this plant is not known to occur within these areas. Populations would fluctuate as a result of activities and available habitat conditions, but individuals would remain in the analysis area.

Spinulose shield fern is located within the Griffith Branch Burn under Alternative C. The plant would be dormant at the time of the burn so no direct impacts are expected. Fire intensity is expected to be low, or not burn at all due the talus present at the site. Burning would result in minimal impacts to habitat conditions allowing this plant to remain at the site. Direct impacts from other activities associated with Alternative C are not expected as this plant is not known to occur within these areas.

Steele's Joe-pye weed was documented in eleven areas proposed for treatment under this alternative. Impacts associated with shelterwood harvest, temporary road construction, and road authorization would be the same as described in Alternative B. Plants located within the prescribed burn areas would not be directly impacted as plants would be dormant when burning takes place. Burning would remove competing woody vegetation and increase light providing favorable conditions for this plant. This may lead to population expansion until woody plants recover from the burn. Thinning would result in the loss of some individuals during treatment. Habitat conditions created by thinning would be very favorable for recovery and expansion. Populations would be expected to increase after treatment for 2-5 years and then slowly decline as canopy cover increases within the stand. Prescribed burning after the thinning would help maintain suitable conditions at the site. Activities at Little Stony Road would also lead to the loss of some individuals during treatment, but establish favorable conditions for recovery when implementation is completed. Creation and maintenance of wildlife openings would also provide opportunities for establishment along forest edges. Direct impacts from other activities associated with Alternative C are not expected as this plant is not known to occur within these areas. Populations would fluctuate as a result of activities and available habitat conditions, but individuals would remain in the analysis area.

Large whorled pogonia was documented in four areas proposed for treatment. Shelterwood harvest would occur at three sites and impacts would be the same as described in Alternative B. Thinning and prescribed burning would occur at the fourth location. Thinning would result in crushing, trampling, and impacting habitat suitability by increasing sunlight and plant competition until canopy cover increases within the stand. Initial population decreases should be expected, but flowering rates would increase where conditions are favorable. Leave areas would be established to protect some plants from harvest. These individuals would serve as part of the the source population for recovery as habitat conditions improve over time. No direct impacts are expected from prescribed burning as plants would be dormant. Removal of leaf litter would reduce habitat quality by impacting moisture conditions (dry out quicker) during the first year after the burn. This may result in a short-term decline in response to drier conditions. Plants would remain within the future stand where suitable habitat is present. Direct impacts from other activities associated with Alternative C are not expected as this plant is not known to occur within these areas. Populations would fluctuate as a result of activities and available habitat conditions, but individuals would remain in the analysis area.

American wintergreen was documented in four areas proposed for prescribed burning, a multi-use trail, and road decommissioning and trail work at Little Stony Road under Alternative C. It is known from six other sites not impacted under this alternative. Habitat would remain suitable, but some impacts would occur from prescribed burning. Populations would experience an initial decline due to the burning off of leaves and changes in microsite conditions (duff, light, and competition). Populations are expected to recover following the burn as remaining individuals resprout. Individuals would remain in the area and future populations would be determined by the habitat conditions present. Some individuals will be lost at Little Stony Road as a result of planned activities. Habitat conditions would be favorable for establishment within the treatment area following the project. Populations would be expected to recover after treatment for 2-5 years. A reduction in the treadway (road to trail) would also provide opportunities for expansion within existing populations. Plants would remain along the future trail corridor and adjacent open woods. No direct impacts are expected at the multi-use trail site as this population has been excluded from treatment. Direct impacts from other activities associated with Alternative C are not expected as

this plant is not known to occur within these areas. Populations would fluctuate as a result of activities and available habitat conditions, but individuals would remain in the analysis area.

Painted trillium was documented in three areas proposed for treatment under Alternative C. Shelterwood harvest would occur at two sites and impacts would be the same as described in Alternative B. The third site is located within the Griffith Branch prescribed burn. Plants would be dormant at the time of the burn. Conditions following the burn would remain suitable. Population may increase depending upon plant competition and reduction in midstory species. Direct impacts from other activities associated with Alternative C are not expected as this plant is not known to occur within these areas. Populations would fluctuate as a result of activities and available habitat conditions, but individuals would remain in the analysis area.

Cumulative Effects for Alternative C

Animals

This alternative would have a positive cumulative effect on *Diana fritillary*. Past and future burning when combined with the ESF proposed under Alternative C would improve the species' foraging habitat and increase habitat diversity in the analysis area. By continuing to provide a diverse forested landscape, this alternative would have a positive cumulative impact on the species' populations in the analysis area.

Alternative C would have an adverse cumulative effect on *Yonahlossee salamander*, *glossy supercoil*, *delicate vertigo*, *cupped vertigo*, and *bidentate dome*. Combined with past and future burning activities, this alternative would have a negative cumulative effect on these species. Past and future burning and proposed ESH in the analysis area would decrease suitable habitat due to the loss of shading, the increased sunlight and elevated temperatures on the forest floor and from the loss of future large woody debris (cover). Suitable habitat would continue to be widespread and abundant however throughout the analysis area, and the species' populations would not be likely to decline measurably.

Alternative C would have no cumulative effects on *gray bat* because activities would not occur in its habitats.

This alternative, combined with past and future burning would have a positive cumulative effect on *Eastern small-footed bat* and *Indiana bat* because snags would be created by all of these activities. The cumulative effect of these activities would be a more open and diverse forest with abundant snags. Additional habitat would be created by natural disturbances, such as wind storms and ice/snow damage, and insect/disease outbreaks. By continuing to protect and provide an abundance of snags, populations of these species would not decline as a result of any of this alternative.

No cumulative effects would occur for *Blackburnian warbler* within the analysis area. No measurable effects to Blackburnian warbler populations or habitat from past or future prescribed burning would occur. Fire would be at a low intensity in suitable habitat and would occur before birds arrive for the breeding season.

When combined with past and future burning, Alternative C would have a positive cumulative effect on *whip-poor-will* habitat by increasing the amount of habitat for the species in the analysis area. Small patches of habitat may be created by prescribed burning and natural disturbances. By

continuing to provide availability shifting mosaic of low elevation ESF, this alternative would help lessen the negative population trend of whip-poor-will in the analysis area and ensure the species' viability across the CNF.

Plants

Cumulative effects to rare plant species would be very similar to those described under Alternative B, except for summer sedge and broadleaf sedge. Known populations of summer sedge and broadleaf sedge are impacted under Alternative C, but these sites do overlap with other prescribed burns considered under cumulative effects (see Table 3r). Broadleaf sedge, which prefers rich, moist deciduous forests (Flora of North America 2002), would experience a decline in habitat quality (lower moisture conditions due to increased light and reduced leaf litter) as a result of past and future burn activities.

Past and future dormant season burns would not result in direct impacts to summer sedge, but it would modify habitat conditions in the analysis area. Prescribed burning would alter light and moisture conditions and create more open forest conditions by reducing woody competition in the midstory and understory layer. Population expansion would be expected in areas where light and moisture conditions remain suitable, but some declines may occur where conditions become too dry. Populations would fluctuate in response to available habitat conditions.

Alternative C and other activities in the analysis area would create a mosaic of habitats capable of supporting many rare species. Alternative C creates less early successional habitat (335 acres) than Alternative B, but adds thinning (204 acres), midstory (116 acres) and prescribed burning (1057 acres) to improve habitat conditions for species that prefer more open forest conditions. Planned activities at Little Stony Road and the multi-use connector trail would reduce human impacts in the Stony Creek drainage, which should benefit species that occupy this area. None of the additional treatments proposed under Alternative C overlap with other prescribed burn considered under cumulative effects (see Table 3r). Management actions proposed under Alternative C, and past and future actions occurring on Forest Service lands are consistent with the RLRMP, and would ensure that suitable habitat remains for rare species within the Cherokee National Forest.

Aquatic Resources

Affected Environment

The affected environment includes the tributaries of the Watuga River that are adjacent to and downstream of the proposed activities. Aquatic habitats in the analysis area include coldwater perennial streams (Table 3v) and scattered wet-weather waterholes.

Table 3v. Perennial Streams in Stony Creek Analysis Area

Stream Name	Fish Present
Bartee Branch	Rainbow trout
Furnace branch	Brook Trout
Griffith Branch	Too small to support fish
Hinkle Branch	Rainbow Trout

Stream Name	Fish Present
Laurel Branch	No fish
Left Fork Mill Creek	Brook Trout
Little Marklin Creek	Too small to support fish
Little Stony Creek	Brook, Brown, Rainbow Trout
Miller Branch	Rainbow trout
Pierce Branch	Too small to support fish
Right Fork Mill Creek	Brook trout
Sam's Cove	Unknown
Unnamed Tributary to Stony Creek	Too small to support fish
Weaver Branch	Too small to support fish

Demand Species

Wild trout (rainbow, brown, and brook trout) can be found in less than nine miles of coldwater streams (Table 3v). *Brook trout*, the only trout native to Tennessee, occupy roughly five miles of these streams. The amount of habitat occupied by brook trout is likely reduced 50% or less from possible historical occupied habitat in the analysis area (Trout Unlimited 2006). This reduction is a result of historical land uses over the last 200 years, particularly around the turn of the last century in East Tennessee. Populations fluctuate from year to year, but their overall trends are stable (CNF 2004c). No rare aquatic species occur within affected areas.

Scope of Analysis

For aquatic species, the scope of analysis includes the tributaries listed in Table 3v. The timeframe used for cumulative effects is five years past and future. This timeframe was chosen due to the limited time frame and minimal impacts project activities would have on aquatic resources.

Effects Analyses of the Alternatives

Alternative A (No Action)

Direct and Indirect Effects

Water quality is analyzed in detail the **Soil and Water** section (pp 40-49) of this EA.

Under Alternative A, deferring the maintenance of system roads may increase sediment in Bartee Branch, Furnace branch, Griffith Branch, Laurel Branch, Little Stony Creek, Pierce branch, and Sam's Cove potentially impacting aquatic resources and trout habitat. Deferring the decommissioning and subsequent actions of Little Stony Road (202A) would also potentially impact aquatic resources and trout habitat. Sedimentation could cause a decrease in fish populations by smothering eggs, trapping young fish in the gravel, or preventing adult fish from escaping into the gravel during periods of high water flow and low water temperatures. Increased turbidity could cause a decrease in growth rates of sight feeders. Sediment carried downstream could scour algae and other tiny organisms from the rocks and streambed material, which would temporarily impact an important link in the food chain of the stream community (Filipek 1993).

Cumulative effects

The No Action alternative would have an adverse cumulative effect on aquatic resources including *wild trout*. When considered with unmaintained system roads and unauthorized roads and trails within the cumulative effects analysis area, Alternative A would continue to allow the movement of sediment into streams and tributaries due to erosion. Aggradation, or the deposition of sediment into the interspaces between gravel and cobble, would reduce habitat conditions for wild trout, other fishes, and invertebrates over time.

Alternative B (Proposed Action)

Direct and Indirect Effects

Wild Trout populations occur in eight of the thirteen streams in the affected areas (see Table 3v). Four streams (see Table 3v) are too small to support fish; however, they are capable of supporting amphibians and invertebrates. Sedimentation impacts to the trout populations from this alternative would be negligible. The proposed vegetation management actions (ESH creation and crop tree release) would have no effects to wild trout.

The establishment of streamside filter zones would protect wild trout populations (USDA Forest Service 2004c) since aquatic habitats within riparian zones are protected under RLRMP Standards. These standards provide for shade strips in harvested areas that would protect the streams from increases in sunlight and excessive fluctuations in water temperature (Sedell 1981).

The proposed temporary roads would have no stream crossings. Existing roads used for hauling, temporary and new road construction, skid trails, and log landings found in drainages adjacent to or downstream from stream reaches may cause a temporary increase in suspended sediment loading during implementation (Filipek 1993). However, compliance with RLRMP standards including streamside filter zones and Tennessee Best Management Practices would keep ground disturbance near streams to a minimum. These measures would protect wild trout and other fish, salamanders, and aquatic invertebrates from impacts due to sedimentation (USDA Forest Service 2004b). The proposed 6.32 miles of road maintenance would help reduce sedimentation in the streams, improving conditions that influence wild trout productivity.

Alternative B would allow herbicide treatments across approximately 383 acres, or less than 5% of the analysis area. The toxicity ratings (SERA) of these herbicides for aquatic organisms are listed in Table 3w. The following measures would minimize the risk of contamination to wild trout and other aquatic organisms:

- Mixing-water for herbicide use would be brought to the site by work crews and not obtained from streams or other bodies of water.
- No herbicide would be applied within 30 feet of open water except for selective treatments that use herbicides labeled for aquatic use.
- Specific methods would be used for application (thinline or stump treatments).
- Design criteria for herbicide use, e.g. timing to avoid rainfall would be used.

Table 3w. Acute Toxicity Ratings for Aquatic Invertebrates

Herbicide	Acute Toxicity Rating
Glyphosate	Practically non-toxic
Imazapyr	Low
Triclopyr	Practically non-toxic

Under Alternative B, two waterholes would provide ephemeral wetland and pond habitats. By being fish free, these habitats would be important for amphibians, crustaceans, and aquatic-dependent insect species such as dragonflies (Biebighauser 2003).

Cumulative effects

Alternative B, in conjunction with past road maintenance, would have a positive cumulative effect on aquatic resources including *wild trout* populations. The activities have and would help reduce sedimentation loads, thereby increasing productivity in Bartee Branch, Furnace branch, Griffith Branch, Laurel Branch, Little Stony Creek, Pierce branch, and Sam's Cove. However, weather events such as floods and droughts have major impacts on wild trout populations in the southern Appalachians (Strange and Habera 1995).

Alternative C

Direct and Indirect Effects

Wild Trout populations occur in eight of the fourteen streams in the affected areas (see Table 3v). Five streams (see Table 3v) are too small to support fish; however, they are capable of supporting amphibians and invertebrates. Sedimentation impacts to the trout populations from this alternative would be negligible. The proposed vegetation management actions (ESH creation, thinning, midstory treatments, and crop tree release) would have no effects to wild trout and would be the same as in Alternative B.

The temporary road to Stand 17 in Compartment 69 (0.7 miles) would cross a tributary of Furnace Branch, using a culvert. The two other proposed temporary roads would have no stream crossings. The proposed 6.32 miles of road maintenance and subsequent actions would help reduce sedimentation in the streams, improving conditions that influence wild trout productivity such as increase in food sources and improved spawning habitat. Decommissioning 5.0 miles of 202A would decrease aggradations of sediment in Little Stony Creek and increase wild trout populations.

Alternative C would allow low-intensity prescribed burns on approximately 1,057 acres in two burn blocks. These burns are intended to be "cool" or low intensity. Some small patches may burn intensely. If a heavy rain event occurs after burning before vegetation and cover are reestablished, erosion may occur in these areas and along fire lines, resulting in sedimentation in the streams (Elliott and Vose 2006). Sedimentation would have the same impacts on trout as discussed in Alternative B. Fire generally burns in a mosaic pattern; leaving patches of cove forests untouched (Sellers 2009). The remaining leaf litter and duff layer in moist areas along streams would protect from sedimentation as a result of burning. Low intensity burns in the Southern Appalachians have been shown to have little impact to stream chemistry or sediment concentrations in streams (Elliot

and Vose 2005). Only four streams would be impacted by these burns, but only one (Furnace Branch) supports fish populations. Impacts to trout would be minimal.

Alternative C proposes herbicide treatments across approximately 655 acres, or less than 6% of the analysis area. Effects of herbicide treatments are discussed under Alternative B. Under alternative C, five waterholes scattered throughout the project area would provide ephemeral wetland and pond habitats. Road authorization, wildlife opening creation, drumming log placement, and nest/bat box installation would have no effects to aquatic resources including wild trout.

Cumulative effects

Cumulative effects of Alternative C would be the same as in Alternative B. Alternative C in conjunction with past prescribed burning would have a negligible cumulative effect on aquatic resources including *wild trout* populations.

Non-Native Invasive Species

Several non-native invasive species (NNIS) occur in the Stony Creek project area. Abundance is average compared to other areas across the CNF. Species diversity is high, but most NNIS occurrences are associated with existing road corridors, wildlife openings, trails, powerline right-of way, abandoned mines, and boundaries with private land. Seven of the eleven NNIS tracked by the RLRMP were identified during surveys for this project (McGuinness 2013). Table 3x lists the tracked NNIS that have been found in areas surveyed for this project. Tracked NNIS species were found in 13 of the 22 sites surveyed within the watershed since 2012 (McGuinness 2013). Other NNIS species not tracked by the RLRMP are also present. These include: Bicolor lespedeza (*Lespedeza bicolor*), Oxeye daisy (*Chrysanthemum leucanthemum*), Wild carrot (*Daucus carota*), and Indian strawberry (*Duchesnia indica*).

Table 3x: Tracked NNIS of the Stony Creek Project Area

Common Name	Scientific Name	Tracked in RLRMP?	Survey Area Locations
Tree of heaven	<i>Ailanthus altissima</i>	Yes	2
Small carpetgrass	<i>Arthaxon hispidus</i>	Yes	0
Autumn olive	<i>Eleagnus umbellata</i>	Yes	0
English ivy	<i>Hedera helix</i>	Yes	0
Sericea lespedeza	<i>Lespedeza cuneata</i>	Yes	7
Privet	<i>Ligustrum sinense</i>	Yes	3
Japanese honeysuckle	<i>Lonicera japonica</i>	Yes	2
Nepal grass	<i>Microstegium vimineum</i>	Yes	12
Princess tree	<i>Paulownia tomentosa</i>	Yes	1
Kudzu	<i>Pueraria montana var.lobata</i>	Yes	0
Multiflora rose	<i>Rosa multiflora</i>	Yes	6

Scope of Analysis

The scope of analysis for direct, indirect, and cumulative effects on Non-native Invasive Species

(NNIS) includes Compartments 66-73, and areas adjacent (0.25 miles) to road's proposed for authorization in Compartments 55, 58, 59, and 60. With the exception of forest visitors acting as vectors, this represents where most source populations of NNIS populations would originate. The timeframe for cumulative effects is the previous five years through five years after completion of the work. Activities considered for cumulative effects analysis are listed in Table 3y.

Table 3y. Activities Considered in Cumulative Effects Analysis

Activity	Acres	Past 5 years	Future 5 Years
Rye Patch Knob Burn	2,613	No	Yes
Big Gap Burn	135	Yes	No
Lindy Camp Burn	348	No	Yes
Old Road Ridge Burn	2,272	No	Yes
Disturbance on private land		Yes	No

Effects Analyses of the Alternatives

Alternative A (No Action)

Direct and Indirect Effects

Some efforts have been made in the past to control NNIS in the analysis area. Most of these efforts have been focused on the road and utility corridors present in the area. NNIS would continue to increase and displace native plants under this alternative. Most of the increase would occur along trails, forest edges, road corridors, power line right-of ways, and other disturbed areas. Use and maintenance of roads, power lines, trails, and wildlife openings in the area would result in some noxious weed control, but these areas would also serve as suitable habitat and as vectors for spread in the area. Illegal trails and continued development on adjacent private land would also serve as point sources for noxious weeds to enter the area. Naturally occurring disturbances as a result of storm damage, insect and disease, and natural mortality would also create opportunities for NNIS establishment within the Stony Creek project area. As NNIS populations expanded and spread into previously uninfested areas, they would continue to erode forest productivity, hinder forest use and management, and degrade diversity and wildlife habitat (Miller et al. 2010).

Cumulative Effects

Past activities within the area (Big Gap and Josiah prescribed burns; road, trail, wildlife, and utility maintenance; and forest visitor use) and activities on adjacent private lands throughout the watershed have provided opportunities for NNIS establishment and spread. Planned prescribed burns at Rye Patch Knob, Lindy Camp, and Old Road Ridge would also provide opportunities for NNIS establishment during and following implementation. Continued development on adjacent private lands would also provide opportunities for establishment based upon the new forest edges that would be created. Therefore, cumulative effects are expected under Alternative A because NNIS would likely continue to spread and/or become established in currently non-infested areas within the project area. These increases would be a result of other Forest Service activities, negligible treatment of existing infestations, forest visitor use, and activities on adjacent private lands within the analysis area.

Alternative B (Proposed Action)

Direct and Indirect Effects

Actions that would result in additional ground disturbance include 1.5 miles of temporary road construction, 6.3 miles of pre-haul maintenance of existing roads, 383 acres of shelterwood harvest, and the construction of two vernal ponds. All of these actions would result in opportunities for further NNIS establishment and spread. Crop tree release (13 acres) is expected to provide little opportunity for NNIS establishment since no ground disturbance would be expected. It does, however, provide an opportunity to monitor current NNIS populations within these stands. Placement of wildlife nest boxes, the creation of drumming logs, and authorization of 8.2 miles of roads already in use are expected to have negligible impacts on the distribution of NNIS species within the watershed.

If NNIS species are already present in the area, implementation of this alternative would provide an opportunity for these populations to expand as a result of the changing habitat conditions and ground disturbance. Introduction of new NNIS species to a treatment area is also possible through equipment use and personnel, and by dispersal into the area from adjacent sites. Several activities implemented under Alternative B border roads, trails, and/or private land. The probability of NNIS establishment and spread within these stands is high following treatment given their proximity to known NNIS sources.

Implementation would decrease local populations of some NNIS species in the project area. Nepal grass, multiflora rose, and other tracked NNIS species (Table 3x) would be controlled with herbicides, along with other invasive species present in the proposed treatment areas. Design criteria for herbicide use would be implemented within treatment areas and along roads to reduce the spread of NNIS in the analysis area. Monitoring and follow-up treatments would be implemented to control future NNIS populations. Post treatment of NNIS species would give native vegetation a competitive advantage, which should further reduce opportunities for NNIS establishment and spread. Control and reduction of NNIS would improve habitats for native plants and wildlife forage, which in turn, would increase wildlife and native plant productivity.

Cumulative Effects

Some past efforts have been made to control NNIS species within the watershed. Efforts in the future beyond those implemented with this project would likely be limited. Other activities occurring in the Stony Creek project area (see NNIS Cumulative Effects, Alternative A) would also provide opportunities for establishment and spread. Alternative B would help control past and future introductions and would be one of the major contributors to the future distribution of NNIS within the analysis area. Development and management of other public and private land would also play a role in the establishment, expansion, spread, and control of NNIS within the watershed. Under Alternative B, monitoring and opportunities for NNIS control would occur when planned activities overlap (ex. harvest and prescribed burning). NNIS would not be eliminated from the analysis area or CNF, but the actions would help control and reduce their rate of spread, ultimately benefitting the natural communities.

Alternative C

Direct and Indirect Effects

Alternative C proposes additional management activities resulting in more ground disturbance than Alternative B. Alternative C reduces the total acres of early successional forest habitat created, and reduces the miles of temporary road construction, but adds thinning and midstory treatments, prescribed burning, road decommissioning and rehabilitation, recreation and wildlife activities. Many of the areas treated under Alternative B are also treated under Alternative C.

Actions resulting in ground disturbance include: 1.3 miles of temporary road construction, 6.3 miles of pre-haul maintenance of existing roads, decommissioning approximately 5.0-miles of Little Stony Road (FSR 202A), 335 acres of shelterwood harvest, 204 acres of thinning, 11 acres of midstory, prescribed burning (1,057 acres), creation of a 0.6 mile multi-use trail connector and parking area, construction of five vernal ponds, and creation and maintenance of wildlife openings. All of these actions would result in opportunities for further NNIS establishment and spread. Crop tree release (13 acres), midstory treatments (116 acres), gate installation, and converting a portion of Little Stony Road to a hiking trail are expected to provide little opportunity for NNIS establishment, but do provide an opportunity to monitor current NNIS populations within these areas. Placement of wildlife nest boxes, the creation of drumming logs, and authorization of 8.2 miles of roads already in use are expected to have negligible impacts on the distribution of NNIS species within the watershed.

Direct and indirect effects on NNIS are similar to those described under Alternative B, but more ground disturbing activities would occur under this alternative than in Alternatives B. Overall, Alternative C would impact a larger portion of the watershed by expanding management activities into additional stands. Some of the activities would overlap (ex. thinning and prescribed burning, road decommissioning and trail establishment), providing multiple opportunities for NNIS establishment, expansion, and spread. Decommissioning Little Stony Road (FSR 202A) on National Forest System lands would help reduce one of the avenues for NNIS species to enter and spread within the watershed.

Implementation would decrease local populations of some NNIS species in the project area. Nepal grass, multiflora rose, and other tracked NNIS species (Table 3x) would be controlled with herbicides, along with other invasive species present in the proposed treatment areas. Design criteria for herbicide use would be implemented within treatment areas and along roads to reduce the spread of NNIS in the analysis area. Monitoring and follow-up treatments would be implemented to control future NNIS populations. Land management activities combined with control and reduction of NNIS would improve habitats for native plants and wildlife forage. This would increase wildlife and native plant productivity by providing a diversity of habitat, age, and site conditions across the Stony Creek watershed.

Cumulative Effects

Some past efforts have been made to control NNIS species within the watershed. Efforts in the future beyond those implemented with this project would likely be limited. Other activities occurring in the Stony Creek project area (see NNIS Cumulative Effects, Alternative A) would also provide opportunities for establishment and spread. Alternative C would help control past and future introductions and would be one of the contributors to the future distribution of NNIS within

the analysis area. Development and management of other public and private land would also play a key role in the establishment, expansion, spread, and control of NNIS within the watershed. Under Alternative C, monitoring and opportunities for NNIS control would occur when planned activities overlap (ex. harvest and prescribed burning). NNIS would not be eliminated from the analysis area or CNF, but the actions would help control and reduce their rate of spread, ultimately benefitting the natural communities.

Scenery Resources

Agency Direction

The USDA Scenery Management System (USDA 1995a) is used to inventory, evaluate and disclose effects to Scenery Resources of the Cherokee National Forest (CNF). During the planning process for the CNF *Revised Land and Resource Management Plan* (RLRMP), existing Scenery Resource inventories were updated. Forest landscapes were evaluated on scenic attractiveness, concern levels, and viewing distances from identified travel-ways and viewing platforms, i.e. roads, trails and recreation sites. Inventoried areas were then assigned a Scenic Class number based on this information.

Affected Environment

The Stony Creek project area includes landscapes inventoried as Scenic Classes 2, 3 and 5. In general, these classes represent landscapes that are high to moderately valued for their natural aesthetic appeal and as settings for outdoor recreation. For example, Scenic Classes 2 and 3 include views of national forest from TN State Highway 91 and the Appalachian National Scenic Trail (A.T.). Scenic Class 5 represents areas of national forest that are sometimes less appealing than other inventoried landscapes or, in the case of the Stony Creek Project, seldom viewed.

Management Prescriptions in the RLRMP prescribe a Scenic Integrity Objective (SIO) for each inventoried Scenic Class. “Scenic Integrity” is measured by “the degree to which a landscape is visually perceived to be ‘complete.’ The highest scenic integrity ratings are given to those landscapes that have little or no deviation from the character valued by constituents for its aesthetic appeal” (USDA Forest Service 1995, p. 2-1). Based on management prescription, viewing distance and user interest within the project area, the RLRMP provides objectives to attain moderate levels of scenic integrity for the project area.

Landscape visibility is a function of many interconnected considerations including: (1) context of viewers, (2) duration of view, (3) degree of discernible detail, (4) seasonal variations, and (5) number of viewers (USDA Forest Service 1995, p.4-2). Major and minor travel-ways, including highways, trails, developed recreation sites, and county and forest roads provide potential foreground, middleground and background views into the Stony Creek project area. The quality of scenery viewed from these travel-ways directly contributes to the quality of a visitor’s recreation experience. Travel-ways in close proximity to the Stony Creek project area include:

- State Highway 91 provides access to recreation opportunities associated with the south side of Holston Mountain, including the Griffith Branch/Hinkle Branch trail complexes. Also, the route connects to trailheads associated with the A.T. and other national forest recreation areas. There are potential foreground and middleground views into the project area.

- The Appalachian National Scenic Trail traverses nearby mountains south of State Highway 91 and the project area. The A.T., an internationally renowned, nationally-designated foot trail, is used by approximately 1,200 thru-hikers and many more day users each year. The trail is easily accessible from the dam at Watauga Lake to the south and from Highway 91 at Cross Mountain near Shady Valley Tennessee to the north. This section of trail runs through the Big Laurel Branch Wilderness and the Big Laurel Branch Wilderness Study Area along the ridge of the Iron Mountains. Potential views to the project area would be far middleground to background.
- Mill Creek Road (FSR 56) and Panhandle Road (FSR 202) provide access to the top of Holston Mountain east of the project area and then Panhandle Road (FSR 202) runs southwest along the ridge of Holston Mountain north of the project area. While this access may be considered a minor travel route with not much traffic, there are potential foreground and middleground views into the project area.

Other travel-ways and use areas that provide viewing platforms into the project area include:

- Various points along trails and closed forest roads in the vicinity of the project area provide opportunities for foreground and middleground views to various parts of the project area.

National Forest System lands are predominately natural-appearing in this area, while local communities/private lands can be characterized as pastoral/agricultural and/or rural/forested landscapes provide short to long-range views of the affected landscape.

Scope of Analysis

The scope of analysis for the direct and indirect effects includes inventoried Scenery Resources, as identified in *Affected Environment* above, within the Stony Creek project area that are visible from noted travel-ways and viewing platforms (see Appendix H). The expected changes or alterations to affected Scenery Resources are described in terms of being consistent or inconsistent with the SIOs as specified in the RLRMP.

SIOs set the thresholds or limitations for creating alterations to the existing natural appearing landscapes. These alterations are typically a result of implementing actions such as silvicultural treatments, wildlife habitat improvements, road construction, prescribed fire, etc. The proposed actions would be considered consistent with SIOs if they could meet the following descriptions within one to five growing seasons after implementation:

- VERY HIGH – The valued landscape character remains intact with only minute if any deviations. The sense of place is expressed at the highest possible level.
- HIGH – Deviations created by humans (such as proposed silvicultural treatments, road construction, prescribed fire, etc.) may be present but repeat the form, line, color, texture and pattern common to the landscape character so completely and at such scale that they are not evident and the landscape appears unaltered.
- MODERATE - Noticeable deviations created by human alterations remain visually

subordinate to the natural appearing landscape being viewed and create only a slightly altered appearance.

- LOW – Noticeable deviations created by human alterations begin to dominate the landscape being viewed but they borrow valued attributes such as size, shape, edge effect and patterns of natural openings and vegetative type changes. Alterations create only a moderately altered appearance. (USDA Forest Service 1995 p. 2-4)

The timeframe for the direct and indirect analysis ranges from the time harvesting activities would take place to approximately 15 years beyond that point. Short-term effects include impacts associated with project implementation, and would occur to one year after completion. This timeframe typically allows the site to be stabilized following a land disturbing activity and for initial slash treatments to become less noticeable. Long-term effects are considered from the time the short term period ends (one year following project completion) until 15 years into the future. This would be the approximate time needed for the harvested areas to regain tree crown cover.

Cumulative effects common to scenery resources would have the greatest potential impact within the immediate vicinity of proposed silviculture treatments for the Stony Creek Project. The cumulative effects analysis includes FS and private lands within the following area: Little Stony Road (FSR 202a) to the southwest, the ridge of Holston Mountain to the northwest, the Clarion Branch tributary to the northeast, and TN Hwy 91 to the southeast. This area encompasses approximately 11,000 acres.

The following vegetation management activities have taken place in the cumulative effects analysis area within the past 10 years:

- Mast tree release with chainsaws, approximately 600 acres.
- Treatments to control Hemlock Woolly Adelgid infestations.
- Chemical treatments of non-native invasive vegetative species.
- Prescribed fire: 2,613 acres, as one burn block (Rye Patch Knob), was burned in 2005.

In addition, approximately 465 acres of wildfire have occurred in the analysis area from 2004 to 2012. Individual fires ranged from 0.1 acres to 244 acres in size.

Reasonably foreseeable future actions in the cumulative effects analysis area within the next 10 years include reburning the Rye Patch Knob prescribed burn block. Treating non-native invasive species, maintaining wildlife habitat improvements, and the routine maintenance of existing system roads and trails are expected to occur. Illegal ATV and other off-road motorized uses would continue to threaten resources in the general forest environment including scenery integrity, and any damage(s) to the resource(s) may need to be remediated.

Past timber harvests, clearings, roads, structures and other landscape modifications are visible on private within the cumulative effects analysis area. The degree to which these modifications on private lands impact scenic quality varies by type, scale and contrast with the surrounding natural landscape. Potential future scenery impacts in the analysis area include increased residential development and gradual loss of the pastoral/agricultural and rural/forested landscape character.

Effects Analyses of the Alternatives

Project-level analysis was conducted in two ways: field reconnaissance from identified travel-ways and terrain modeling using GIS applications. A spatial analysis helped determine the areas in affected compartments that are potentially visible from identified viewing platforms. This analysis is based on terrain only, but, with field verification at project level.

Scenery design features have been developed to help achieve SIOs as described above. For this analysis, the scenery design features are considered as part of the proposed actions in Chapter 2 of the environmental assessment (EA). They primarily address activities related to proposed silvicultural treatments and wildlife habitat improvements. Refer to Appendix H for a listing of “Recommended Scenery Design Features for Areas Visible from Noted Travelways & Viewing Platforms.” The direct and indirect effects to Scenery Resources have been based on the assumption that these design features would be implemented to the extent practicable to achieve the assigned SIOs. For example, a design feature might recommend that log landings be strategically located to avoid being conspicuous from a noted travelway.

The resiliency of vegetation in the Southern Appalachian Mountains has also been taken into consideration when disclosing the temporal nature of effects to Scenery Resources, the consistency with assigned SIOs and the application of scenery design features. For example, a design feature may recommend the lopping and scattering of slash to a height of four feet or less from the ground if viewed within 100-feet from a noted travelway. The visual effect of scattered down woody debris at this height would noticeably diminish within the first year due to rapid decomposition and growth of surrounding seedlings and saplings. The affected areas would most likely meet a MODERATE SIO during the second or third growing season after implementation. Direct, Indirect and Cumulative effects of the alternatives on Scenery Resources are provided below.

Alternative A (No Action)

Direct and Indirect Effects

Under this alternative, the proposed action would not be implemented. The overall effect of the no-action alternative would be no change to the existing natural-appearing landscape and no significant negative effects to scenery and recreation resources. Scenery Resources however would continue to change over time due to natural processes.

The natural succession of vegetation and disturbances such as fire, insects, disease, and storms would continue to alter the appearance of landscapes within the project area at various scales. Tree diameters would increase in size, a positive effect along travel corridors. However, there would be no enhancements or restorations to improve scenery or create visual diversity, either short or long term, which would affect both scenery and recreation resources. Emergency forest health and safety projects may be implemented, but projects to improve the overall health of the forest may not be implemented. Tree mortality that may occur due to the Hemlock Woolly Adelgid, Pine Beetle or other invasive pest would be noticeable over time.

Road rehabilitation, authorizing existing roads, decommissioning authorized and unauthorized roads, rehabilitation of existing wildlife openings and other proposed wildlife and fisheries habitat projects would not occur, potentially adversely affecting forest access for hunting, fishing, wildlife viewing, hiking and backpacking.

Prescribed burning has been used periodically in the Stony Creek area to reduce fuels that would contribute to wildfire, and to promote forest health and provide wildlife benefits by renewing the mid- and understory vegetation. It is anticipated that this practice would continue. Its short-term effects to scenery are scorched vegetation, usually lasting only a few weeks. Effects over a longer period of time (immediately to a few years) are a reduction of downed woody debris and a more open forest, changes that benefit both scenery and recreation for those users who enjoy hunting, wildlife viewing and longer views into the natural-appearing woodland. By implementing this Alternative, SIOs of “Moderate” in the project area would continue to be met.

Cumulative Effects

The overall effect of implementing Alternative A would be an older forest, but with no enhancements or restorations to improve scenery or create visual diversity. Emergency projects in response to forest health and safety may be implemented, but no projects to improve the overall health or populations of the forest would be implemented. No cumulative effects for either Scenery or Recreation, other than direct and indirect effects previously discussed, are anticipated.

General Discussion Relative to Alternatives B and C

For all action alternatives, the table in Appendix H identifies Stand number, Management Prescription, assigned SIO, Proposed Treatment type and visibility from analyzed viewing platforms and travel-ways. As indicated in the “Viewing Platform” column, stands may be seen from more than one viewing platform; this combined effect is considered during analysis.

Scenery design features common to all stands include feathering unit boundaries to avoid straight edges; retaining natural-appearing groups of trees; minimizing soil disturbance so constructed features like roads and skid trails blend and remain subordinate to the landscape; screening log landings from view, with restoration of the area as close to the original landscape as practical. When the desired landscape character is “natural appearing,” the appearance of a continuous forested canopy would be achieved by retaining trees at intervals throughout the stand, based on the prescribed basal area (BA) and refined in the field prior to implementation.

Leaving a higher tree density in areas closest to the viewer and especially along ridgelines and travel routes reduces textural and color contrasts between the treated area and adjacent forest. Also, retaining several vertical feet of vegetation along skyline ridges maintains the continuous effect of a natural-appearing forest. Edge-feathering reduces or eliminates shadow-lines along unit boundaries. These and other design features effectively soften visual impacts of timber harvesting and allow assigned SIOs to be met.

When viewed as Middleground (1/2 to 4 miles from the viewing platform), shelterwood harvest areas may appear to be more sparsely vegetated or have fewer trees than adjacent un-cut stands, but do not create a distinct opening as with clear-cut harvests (not proposed). To the average viewer, a shelterwood harvest of 15-20 square feet ba/acre may be noticeable for ten or less years after harvest, while a 30+ square feet ba/acre treatment may be noticeable for a shorter time. An area with a higher reserve basal area, with a denser canopy cover and a greater number of remaining tree stems would be less noticeable when over-viewing the forested canopy. In leaf-on season, Middleground views of shelterwood harvest treatments may allow varying degrees of visible ground beneath the remaining overstory trees or individual stems may be more distinct. In certain lighting conditions, shadows beneath residual trees may make the stand appear darker and

have a more coarse texture than the adjacent forest. Within two or three growing seasons, crowns of residual overstory trees expand to create a denser canopy, and understory vegetation grows to obscure views of ground exposed during harvest. In leaf-off, shelterwood harvest treatments appear more like adjacent un-cut stands, except for the tree density. However, roads, log landings and logging debris may be more noticeable.

In general, visitors walking or driving in the remote parts of the forest where these activities are proposed would notice the following effects of harvesting: decreased canopy cover; increased sunlight; increased visibility into the forest; damaged living vegetation from logging activities; and visible debris, stumps and root wads on the ground. The height of remaining slash (debris, stumps and root wads) would range four feet or less in height, depending on the area's SIO and visibility from noted travel-ways. After a harvest, forest visitors would notice the effects of manual site preparation, chemicals and prescribed burning, techniques used to eliminate undesirable species and promote desired tree species. These activities would produce additional downed woody debris, scorched vegetation from burning and a more open forest.

Post harvest evaluation by specialists would determine visibility of road and skid trail banks and beds within treatment areas. If necessary, additional treatments would be used to reduce harvest-related alterations of established form, line, color and texture.

Alternative B (Proposed Action)

Direct and Indirect Effects

Actions proposed in Alternative B that would affect Scenery Resources include silvicultural treatments, wildlife habitat improvements and transportation improvements.

Silvicultural Treatments

Of the 383 acres (11 stands) proposed for early successional forest habitat creation, 32 acres (one stand) would be regenerated noncommercially. The remaining 351 acres (10 stands) would be commercially harvested through the shelterwood method. Additionally, crop tree release is proposed for 13 acres (two stands).

Converting existing forested areas to the desired early successional forest stage would create the most noticeable impacts to the existing forest scenery. Some visitors may notice the tree removal due to openings created in the tree canopy and the color contrast of disturbed soil. These contrasts would be expected to diminish after each growing season as regenerating hardwood trees occupy the openings. To the average viewer, a shelterwooded stand with a residual basal area of 15-20 square feet per acre may be noticeable for ten or less years after harvest.

In the short term, pre- and post-harvest site preparation would have the most noticeable effect on the scenic resource due to unseasonable leaf drop, particularly in the immediate foreground of travel-ways. Brown leaves and dead stems that result from herbicide treatments would be evident for a growing season or less, but the opening of the stands would have positive long-term effects on scenery, wildlife viewing and hunting overall.

Crop tree release would have a positive effect on the scenery in the area by increasing the depth of views into the forest.

Controlling non-native invasive species would have a positive long-term effect on the scenery resources of this area by maintaining and improving habitat for native Appalachian mountain flora. Established SIOs would only be affected in the short term (one growing season or less) after herbicide application due to an unseasonable leaf drop.

Wildlife Habitat Improvements

This alternative proposes to create drumming logs and wildlife watering holes, and place roosting/nesting boxes for birds and other wildlife within the project area. These features would draw wildlife to the area, a positive long-term effect on recreation opportunities for hunting and wildlife viewing. The proposed wildlife habitat activities would have little or no effects to recreation and scenery resources. Established SIOs would only be affected in the short term (one growing season or less) after implementation.

Transportation Improvements

The proposed 6.3 miles of prehaul maintenance would expose previously undisturbed areas of mineral soil, increasing viewshed visibility of those roads. However, this would have minimal long-term impacts to scenery resources in the area. The proposed construction of 1.5 miles of temporary roads would provide visual diversity and would afford views to the surrounding landscape. Where temporary roads coincide with existing trails, design features recommend the retention of vegetative buffers and retention of large trees in the immediate foreground to help frame views and reduce scenery impacts in the immediate foreground. Even with obliteration and seeding, temporary roads are distinguishable as corridors because of residual cut banks, lost canopy and flattened roadbed. Efforts would be made to restore temporary roads to their predevelopment contour and design features recommend reseeding and planting to reduce scenery impacts. Here again the resulting openings would provide visual diversity and afford views to the surrounding landscape.

Trails impacted by temporary road construction would be restored to their pre-development state prior to or shortly after project completion. Direct effects would diminish each year as growing seasons pass, new saplings emerge, and leaf litter accumulates within the project area. The affected scenery would remain natural appearing and consistent with the assigned SIO of moderate within the project area.

Approximately 8.2 miles of roads would be added to the Forest Service transportation system per the Stony Creek Travel Analysis Plan. Since the roads currently exist on the ground, minimal impact to scenery resources would be involved and the assigned SIO's would be met.

Alternative C

Direct and Indirect Effects

Actions proposed in Alternative C that would affect Scenery Resources include silvicultural treatments, wildlife habitat improvements and transportation improvements.

Silvicultural Treatments

Effects on scenic resources for early successional forest habitat creation and crop tree release would be similar to those described for Alternative B, but on a slightly smaller scale due to the

decreased number of shelterwood treatment acres—335 acres versus 383 acres, Alternative C and B respectively— proposed in this alternative. As in Alternative B, 32 acres (one stand) would be regenerated noncommercially, and 13 acres (two stands) of crop tree release is still proposed.

Alternative C adds proposed silviculture treatments for midstory and thinning—116 acres and 204 acres respectively, and proposes to prescribe burn approximately 1,057 acres. Scenery design features to meet Moderate SIOs in the treated stands are the same as those for Alternative B.

As with pre- and post-harvest treatments for shelterwooded stands, unseasonable leaf drop from the midstory treatments would have the most noticeable effect on the scenic resource in the short term, particularly in the immediate foreground of travel-ways. Brown leaves and dead stems that result would be evident for a growing season or less, but the opening of the stands would have positive long-term effects on scenery, wildlife viewing and hunting.

By increasing the depth of views into the forest, the proposed 204 acres of thinning and pre- and post-harvest treatments would have a positive effect on the scenery in the area similar to that of shelterwood treated areas.

Prescribed burning would reduce fuel loading that contributes to wildfire intensity, and would promote forest health and provide wildlife benefits by renewing the mid- and understory vegetation. Short-term effects to scenery would be scorched vegetation and blackened tree trunks. Effects over a longer period of time (immediately to a few years) would be a reduction of downed woody debris and a more open forest, changes that benefit both scenery and recreation for those users who enjoy hunting, wildlife viewing and longer views into the natural-appearing woodland.

Wildlife Habitat Improvements

This alternative proposes to create three additional wildlife watering holes within the project area for a total of five water sources. These features would draw wildlife to the area, a positive long-term effect on recreation opportunities for hunting and wildlife viewing. The addition of a 0.7-mile linear wildlife opening and a 2.0-acre spot wildlife opening would provide visual diversity and would afford views to the surrounding landscape. Proposed wildlife habitat activities would have little or no effects to recreation and scenery resources. Established SIOs would only be affected in the short-term (one growing season or less) after implementation.

Transportation Improvements

The effects of the proposed 6.3 miles of pre-haul road maintenance under Alternative C on scenery resources would remain the same as that discussed in Alternative B. Under Alternative C, the length of proposed temporary road construction would decrease by nearly 0.2 miles, from 1.5 miles under B to 1.3 miles under C. Scenery design features to meet Moderate SIOs for the proposed pre-haul and temporary roads would be the same as Alternative B.

Alternative C proposes the decommissioning of the 5.0 miles of Little Stony Road (FSR 202A) on National Forest System lands, and proposed various treatments along the existing alignment to obliterate, obliterate and recontour or maintain the old roadbed as a hiking/fishing trail. In addition, a multi-use connector trail is proposed to connect the upper portion of Little Stony Road (FSR 202A) to Furnace Branch Road (FSR 60682). This activity would provide visual diversity and would afford views to the surrounding landscape. Activities associated with the proposed work

would have minimal impact to the scenery resources of the area. SIO's of moderate would be maintained.

Activities associated with adding roads to the forest system would have the same effects as those described in Alternative B.

Cumulative Effects for Alternatives B and C

When considered with the proposed vegetation management actions under Alternatives B and C, past actions, e.g. herbicide treatments for NNIS and HWA, midstory treatments, and the 2005 prescribed burn, would have beneficial long-term cumulative effects on the Scenery resources within the analysis area.

Vegetation management actions planned within the next 10 years that would affect the Scenery resource includes the approximately 2613-acre Rye Patch Knob prescribed burn. When considered with the proposed 1,057 acres of prescribed burning (two burn blocks in Alternative C only), the short-term cumulative effect would be a larger area (approximately 33% of the analysis area) potentially showing scorched vegetation and blackened tree trunks. However, it is unlikely that all three burn blocks would be treated at the same time, i.e. within the same year or years. This would essentially stagger the effects both spatially and temporally within the analysis area, thereby reducing the overall impacts on the Scenery resources. Long term, the resulting more open forest would benefit both scenery and recreation by creating a more natural-appearing woodland. There are no other vegetation management actions planned in the analysis area within the next 10 years.

The wildlife habitat improvements and transportation improvements, including the impacts on trails, proposed under both alternatives would have long-term beneficial cumulative impacts when considered with similar future actions. The increase in wildlife-viewing and hunting opportunities, and visual and viewshed diversity would provide recreation users with a more enjoyable experience when visiting FS lands.

Cumulatively, although there would be short-term impacts, management-influenced SIOs would continue to be met over the long term.

Recreation Resources

Affected Environment

Visitors to the Watauga Ranger District choose the Stony Creek area's mountainous settings to engage in a variety of popular recreation activities including, but not limited to hiking, biking, horseback riding, camping, backpacking, hunting, fishing, sightseeing (wildlife and scenery) and driving for pleasure. The area along the southeast slope of Holston Mountain and northwest slope of the Iron Mountains, referenced as the Holston Mountain and Iron Mountains Recreation Zones, contains a complex of trails, roads and streams that provide opportunities for many of the activities mentioned above. The area also provides access to similar opportunities along the northwest side of Holston Mountain, including South Holston Lake. Prominent travel corridors provide additional access to developed and dispersed recreation opportunities nearby.

Per the RLRMP, six recreation-related prescriptions are found within the Stony Creek Analysis Area (SCAA):

- The Big Laurel Branch Wilderness area (Prescription 1.A) and the Big Laurel Branch Addition (1.B) border the southeastern boundary of the SCAA. The Big Laurel Branch Wilderness and Big Laurel Branch Addition include a total of 11,921 acres, of which 7,199 acres are within the analysis area. The combined acreage is managed for the benefits of designated wilderness, including but not limited to opportunities for remote backcountry experiences and seclusion. Most use is by Appalachian National Scenic Trail (AT) hikers, along with some hunters along the periphery.
- A 19-mile length of the AT (4.A) bisects the Big Laurel Branch Wilderness and Big Laurel Branch Addition, from Watauga Lake Dam to Turkeypen Gap. The AT is located along the crest of the Iron Mountains, a prominent ridge paralleling Holston Mountain. The AT attracts local, national and international visitors throughout the year.
- The approximately 11,000 acres of Dispersed Recreation Areas - Suitable (7.E.2) are primarily found within the southeastern slope of Holston Mountain. This area is located within the Holston Mountain Recreation Zone, and includes the Holston Mountain Horse Trail Complex with over 30 miles of trail; Little Stony Creek, a high quality trout stream; and the Blue Hole waterfall recreation site.
- The nearly 3,000 acres of Remote Backcountry Recreation - Few Open Roads (12.A), and over 3,000 acres of Remote Backcountry Recreation - Non-motorized (12.B), found in both affected Recreation Zones, are managed to provide users with a degree of solitude and a semi-primitive experience in large remote areas.

Scope of Analysis

The scope of analysis for direct and indirect effects to Recreation Resources are the approximately 29,089 acres of National Forest Service lands in the Stony Creek Analysis Area. Cumulative effects includes the private lands within the SCAA. The timeframe for cumulative effects is from the present to approximately 10 years in the future.

Effects Analyses of the Alternatives

Alternative A

Direct, Indirect and Cumulative Effects

Under this alternative the proposed actions would not be implemented. The overall effect would be no changes to the recreation resources. Deferring the wildlife habitat improvements could result in fewer opportunities for hunting, fishing and wildlife viewing. There would be no cumulative effects to the recreation resource under the No Action alternative.

Alternative B (Proposed Action)

Direct and Indirect Effects

Direct effects to recreation resources would be possible displacement of dispersed recreation users that may be in a treatment area(s) during project implementation. Any effects would be temporary, lasting until project activities were completed. The proposed creation of 383 acres of early successional forest habitat and 13 acres of crop tree release would create a more open forest for

picnicking, hunting and wildlife viewing. The possible planting of blight resistant American chestnut could provide unique enjoyment for future recreationists.

The proposed 6.3 miles of pre-haul road maintenance would occur within the Holston Mountain Horse Trail Complex where the roads are currently used by equestrians. The proposed activity would improve road conditions for riding through grading and graveling, along with the construction of appropriate drainage control features. There is an opportunity to improve trail conditions where temporary roads are proposed along existing trails.

In addition, the construction and maintenance of wildlife boxes fish structures, vernal ponds, and grouse drumming logs would draw wildlife and fish species to these constructed features, providing a positive long-term effect on recreation opportunities such as wildlife viewing, fishing and hunting.

The roads proposed to be authorized are existing non-system roads, with eight of the 8.3 miles currently being used for powerline maintenance. The addition of OR-8 to the FS system would benefit recreationists that use the Blue Hole waterfall recreation site by providing a means for better management of the area. OR-01, OR-02, OR-03 and OR-04 parallel the Big Laurel Branch Addition where motorized use is not allowed. Though gated closed roads, there is concern over their proximity to the wilderness study area. To address this concern, the roads would not be identified on recreation maps, thereby discouraging illegal motorized use of the roads and intrusion into areas managed as wilderness.

Cumulative Effects

No cumulative effects for Recreation are anticipated. Past activities in the Stony Creek project area have resulted in the present conditions discussed in the Affected Environment section above. There are no foreseeable projects in this area for the next 10 years that would affect the recreation resource.

Alternative C

Direct and Indirect Effects

Alternative C reduces the total acres of early successional forest habitat created, decreasing the recreation benefits, such as hunting and wildlife viewing, associated with ESF. However, the addition of 116 acres of midstory treatment, 204 acres of thinning treatment, 0.7 miles of linear wildlife opening and the 2.0-acre spot wildlife opening proposed under this alternative would provide additional opportunities for recreation users of the area.

The additional vegetation management treatments and the 1,057 acres of prescribed burning proposed in Alternative C would increase potential impacts to dispersed recreationists in the area during treatment; however, any additional impacts would be temporary and the areas would continue to provide dispersed recreation opportunities post-harvest. Increasing mast-producing species and the resultant increase in wildlife may increase use of the area by birders, nature photographers, hunters, and others. Thinning and prescribed burns would lead to a healthier forest and a more enjoyable experience for recreationists.

Decommissioning Forest Service Road 202A (Little Stony Road) and the associated adjustments

would have a beneficial impact on primary recreation users in the area such as equestrians, hikers and fishers. Sections of the existing roadbed proposed for the hiking trail are entrenched with exposed rocky portions, resulting in more difficult tread and creating a less desirable trail experience. The proposed modifications to FR 202A would create a quality trail experience for multiple user types, providing overall improvement to the recreation opportunities in the area.

Cumulative Effects

No cumulative effects for Recreation are anticipated. Past activities in the Stony Creek project area have resulted in the present conditions discussed in the Affected Environment section above. There are no foreseeable projects in this area for the next 10 years that would affect the recreation resource.

Climate Change

Affected Environment

Climate change can affect the resources in the project area and the proposed project can affect climate change through altering the carbon cycle. Climate models are continuing to be developed and refined, but the two principal models found to best simulate future climate changed conditions for the various regions across the country are the Hadley Centre model and the Canadian Climate Centre model (U.S. Global Change Research Program 2001). Both models indicate warming in the southern region of the United States. However, the models differ in that one predicts little change in precipitation until 2030 followed by much drier conditions over the next 70 years. The other predicts a slight decrease in precipitation during the next 30 years followed by increased precipitation. These changes could affect forest productivity, forest pest activity, vegetation types, major weather disturbances (droughts, hurricanes), and streamflow. These effects would likely be seen across the Forest.

Scope of Analysis

The scope of this analysis for direct, indirect, and cumulative effects on climate change includes the suitable acres of Forest Service lands in stands proposed for vegetation management/treatment and prescribed burning (see Chapter 2, Alternatives B and C, pp 18-20 and 23-27, respectively, of this EA). The time frame used in this analysis is up to ten years after completion of the activities.

Effects Analyses of the Alternatives

Alternative A (No Action)

Direct and Indirect Effects

In general terms, Alternative A (No Action) would result in no change to the current trend for carbon storage or release. Forested stands are expected to be less resilient to possible climate change impacts, such as changes in productivity or insect and disease.

Alternatives B (Proposed Action) and C

Direct and Indirect Effects

It is not expected that the action Alternatives B or C would substantially alter the effects of climate

change in the project area. The regeneration in the areas to be harvested would provide more structural diversity to the area, and establish a young, vigorous stand of timber that may be more resilient to the changes in climate. Midstory treatment utilizing herbicides, mechanical treatment methods for crop tree release, and thinning (only in Alternative C) would provide an opportunity to enhance the resilience health of productivity of the remaining ecosystem to withstand climate change stresses.

In general, genetic diversity provides resilience to a variety of environmental stressors (Moritz, 2002, Reed and Frankham, 2003, Reusch et al., 2005). Climate change affects biodiversity directly by altering the physical conditions to which many species are adapted. In some instances, changes in precipitation patterns may disrupt animal movements and influence recruitment and mortality rates (Inouye et al., 2000). Evidence is accumulating to indicate that species interactions and competitive responses under changing climates are complex and unexpected (Suttle, Thompson, and Power, 2007). Although species with large geographic ranges have a wide range of physiological tolerance, species that are rare, threatened, endangered, narrowly distributed, and endemic, as well as those with limited dispersal ability, would be particularly at risk under climate change (Pounds et al., 2006) because they may not be able to adapt in situ or migrate rapidly enough to keep pace with changes in temperature (Hansen et al., 2001; Wilmsking et al., 2004; Neilson et al., 2005b). A key predicted effect of climate change is the expansion of native species' ranges into biogeographic areas in which they previously could not survive (Simberloff, 2000; Dale et al., 2001). This prediction is supported by the observed northward shift in the ranges of several species, both native and introduced, due to the reduction of cold temperature restrictions (Parmesan, 2006).

Maintenance of genetic diversity provides resilience to a variety of environmental stressors. Climate change affects biodiversity by altering the physical conditions to which many species are adapted. Range distribution for species varies.

Projected changes in temperature and precipitation suggest that southern ecosystems may shift dramatically. Depiction of the northern shift of the jet stream and the consequent drying of the Southeast (Fu et al., 2006) varies among future climate scenarios, with some showing significant drying with others show increased precipitation (Bachelet et al., 2001). Even under many of the somewhat wetter future scenarios, closed-canopy forests of the Southeast may revert or in some areas, be converted under temperature-induced drought stress (Bachelet et al., 2001; Scholze et al., 2006). Temperature induced droughts in Mountain ecosystems are expected to contribute to forest diebacks (Bugmann, Zieri, and Schumacher, 2005; Millar, Westfall, and Delaney, forthcoming).

The interactions of climate change with other stressors such as insects (Volney and Fleming, 2000; Logan, Regniere, and Powell, 2003), disease (Pounds et al., 2006) would challenge the management of ecosystem services and biodiversity conservation in NF ecosystems. Older forests can be strong carbon sinks (Stoy et al. 2006), and older trees absorb more CO₂ in an elevated CO₂ atmosphere, but wood production of these trees show limited or only transient response to CO₂ (Korner et al. 2005). Studies of elevated CO₂ on trees have been done with young trees (which show a positive growth response), but the one study on mature trees showed no growth response (Korner, et al. 2005). This is consistent with model results found in an independent study (Kirschbaum 2005). The general findings from a number of recent syntheses using data from the three American and European FACE sites (King et al. 2004; Norby et al. 2005; McCarthy et al. 2006a; Palmroth et al. 2006) show that North American forests will absorb more CO₂ and might

retain more carbon as atmospheric CO₂ increases. In this study, thinning removed carbon from the stand (in the form of removed logs) and also resulted in substantial, but temporary, reduction in ANPP (aboveground net primary production). The reduction of ANPP by thinning lasted only one year, and its recovery was likely due to changes in the foliar mass and leaf traits. Finally, the data portrayed that there is a transient impact of thinning on ANPP, but that there is no long-term effect of thinning on aboveground carbon uptake in oak forests. Although this study focused on oak forests, the same principles and effects would apply to the hemlock forests.

The alternatives would alter the carbon cycle in that it affects the carbon stock in any one of the pools. Each alternative would remove biomass which would reduce the amount of carbon stored in the treated stands. A portion of the carbon removed would remain stored for a period of time in wood products.

The increase in down, dead wood would temporarily convert stands from a carbon sink that removes more carbon from the atmosphere than it emits, to a carbon source that emits more carbon through respiration than it absorbs. These stands would remain a source of carbon to the atmosphere until carbon uptake by new trees and other vegetation exceeds the emissions from decomposing dead organic material. The stands would likely remain a carbon source for several years, and perhaps for more than a decade, depending on the amount of dead biomass left on site, the length of time before new trees become reestablished, and their rate of growth once reestablished. As the stands continue to develop, the strength of the carbon sink would increase until peaking at an intermediate age and then gradually decline but remain positive. Similarly, once new trees are established, carbon stocks would accumulate rapidly for several decades. The rate of accumulation would slow as the stands age. Carbon stocks would continue to accumulate, although at a declining rate, until impacted by future disturbances.

Recent scientific literature confirms this general pattern of changes in net ecosystem productivity (NEP)¹ and carbon stocks over the period of forest stand development. Most mature and old stands remained a net sink of carbon. Pregitzer and Euskirchen (2004) synthesized results from 120 separate studies of carbon stocks and carbon fluxes for boreal, temperate, and tropical biomes. They found that in temperate forests NEP is lowest, and most variable, in young stands (0-30 years), highest in stands 31-70 years, and declines thereafter as stands age. These studies also reveal a general pattern of total carbon stocks declining after disturbance and then increasing, rapidly during intermediate years and then at a declining rate, over time until another significant disturbance (timber harvest or tree mortality resulting from drought, fire, insects, disease or other causes) kills large numbers of trees and again converts the stands to a carbon source where carbon emissions from decay of dead biomass exceeds that amount of carbon removed from the atmosphere by photosynthesis within the stand.

The impacts of the action alternatives on global carbon sequestration and atmospheric concentrations of CO₂ are miniscule. However, the forests of the United States significantly reduce atmospheric concentrations of CO₂ resulting from fossil fuel emissions. The forest and wood

¹ Net ecosystem productivity, or NEP, is defined as gross primary productivity (GPP) minus ecosystem respiration (ER) (Chapin et al. 2006). It reflects the balance between (1) absorbing CO₂ from the atmosphere through photosynthesis (GPP) and (2) the release of carbon into the atmosphere through respiration by live plants, decomposition of dead organic matter, and burning of biomass (ER). When NEP is positive, carbon accumulates in biomass. Ecosystems with a positive NEP are referred to as a carbon sink. When NEP is negative, ecosystems emit more carbon than they absorb. Ecosystem with a negative NEP are referred to as a carbon source.

products of the United States currently sequester approximately 200 teragrams² of carbon per year (Heath and Smith, 2004). This rate of carbon sequestration offsets approximately 10% of CO₂ emissions from burning fossil fuels (Birdsey et al., 2006). U.S. Forests currently contain 66,600 teragrams of carbon. The short-term reduction in carbon stocks and sequestration rates resulting from the proposed project are imperceptibly small on global and national scales, as are the potential long-term benefits in terms of carbon storage.

The currently large carbon sink in US forests is a result of past land use changes, including the re-growth of forests on large areas of the eastern U.S. harvest in the 19th century, and 20th century fire suppression in the western U.S. (Birdsey et al. 2006). The continuation of this large carbon sink is uncertain because some of the processes promoting the current sink are likely to decline and projected increases in disturbance rates such as fire and large-scale insect mortality may release a significant fraction of existing carbon stocks (Pacala et al. 2008; Canadell et al. 2007). Management actions – such as those proposed – that improve the resilience of forest to climate-induced increases in frequency, and utilize harvested trees for long-lived forest products and renewable energy sources may help sustain the current strength of the carbon sink in US forests (Birdsey et al. 2007).

Prescribed Burning (Alternative C only)

Burning in forests incites concerns about global climate changes; climate change may be exacerbated by forest fires if allowed to burn frequently and out of control over large areas. Climate change may occur in part because the burned forest areas are no longer sequestering carbon dioxide at the same rate as pre-fire, and carbon stocks that had been stored within the biomass of the forest are released into the atmosphere. However, unlike large wildfires, prescribed burns are generally only low- to moderate-intensity and cover only small areas at a time. They do not result in large-scale tree death, as wildfires sometimes do. On the contrary, research indicates that regular, periodic prescribed burning results in a reduction of risk of catastrophic wildfire occurrence. The short-term loss of biomass resulting from a fire may be offset by the burned area's increased ability to produce herbaceous biomass. Additionally, mature forests sequester carbon at a lower rate than younger forests, and therefore management activities such as prescribed fire that maintain a variety of forest ages may increase the ability of forest tracts to sequester carbon. Management actions (such as prescribed burning) that improve the resilience of forests to climate-induced disturbances such as catastrophic wildfire may help sustain the current strength of the carbon sequestration ability of U.S. forests. Finally, at a global or national scale, the short-term reduction in carbon stocks and sequestration rates of the proposed burn project are imperceptibly small, as are the potential long-term benefits.

Cumulative Effects for All Alternatives

For all alternatives, the release of stored carbon may be an obvious concern; the contribution of the proposed project areas to the carbon cycle is extremely small. When combined, the carbon from these projects has minimal cumulative effect not only at the local level, but at the larger level. When implemented, the risk and rate of additional carbon release through regeneration is minimal for the reasonably foreseeable future.

² 200 teragrams, or Tg, equals 196,841,306 US tons.

Cultural Resources

Affected Environment

Cultural resources are the non-renewable, physical remains of prehistoric and historical human activities. They are subject to damage or destruction from land disturbing activities, including those associated with vegetation manipulation and road construction. Area disturbance can damage or destroy the historical, cultural, or scientific integrity of historical or prehistoric resources. Disturbance of historical sites, such as old cabins, can reduce the ability to reconstruct the recent history of settlement in the local area. Disturbance of ethnographic sites, such as traditional Native American campsites or burial grounds, can reduce the interpretive significance of the site or can infringe on religious rites.

Current CNF direction is to protect significant cultural resources from adverse impacts that may occur from land disturbing activities, and to inventory NFS lands in order to locate and evaluate all cultural resources. This policy is based on adherence to Federal and state laws and regulations. Cultural resources are closely coordinated with the State Historic Preservation Officer (SHPO). In compliance with executive order 11593, the National Historic Preservation Act, NEPA, and FS regulations (Forest Service Manual 2360), a cultural resource inventory was performed to determine if potentially significant cultural resources would be affected.

Scope of Analysis

The scope of analysis is the individual boundaries of the areas identified in each of the alternatives. The time frame is from if and when the project is implemented to the time of completion.

Effects Analyses of the Alternatives

Alternative A (No Action)

Direct, Indirect and Cumulative Effects

This alternative would have no effect on cultural resources. There is limited potential for discovery of currently unknown sites. There would be no known cumulative effects.

Alternatives B (Proposed Action) and C

Direct, Indirect and Cumulative Effects

Alternatives B and C would not affect cultural resources as long as site(s) that have potential eligibility for inclusion in the National Register of Historic Places (NRHP) would be avoided during project implementation. Forest Service Heritage Resource records document that all areas of proposed ground disturbance (timber sale, etc) have been previously surveyed on multiple previous occasions for cultural resources. No significant cultural resource sites were documented in any of these previous field surveys or in research of the historic records for these survey areas. If cultural resources were to be discovered during project implementation, the project would be halted until the resource(s) is/are evaluated. There would be no known cumulative effects.

Economics

Affected Environment

An analysis of the economic efficiency of the alternatives was conducted in order to provide a reliable means to contrast the relative costs and benefits of the proposed activities. The analysis provides the Responsible Official with the assurance that economic efficiency was considered. It also provides some information about the potential economic impacts of the alternatives.

Cost and unit estimations were derived from field data, maps, and actual prices from similar projects. The values of timber products were derived from current market data, which are exceptionally low at this time. The economic analysis only looked at stumpage-related benefits and the costs involved in preparing and implementing a timber sale. Timber harvesting activities may result in changes, both positive and negative, to other resources such as wildlife or recreation. These changes can have an associated economic value, but they are difficult to quantify in amount or value, and are therefore not considered in this analysis.

Scope of Analysis

The scope of analysis is generally the communities within about one hundred miles of the project area. The time frame is generally from when the project is first implemented through the completion of reforestation, which is generally three years. Only the net present value of the commercial timber sale is discussed.

Effects Analyses of the Alternatives

Alternative A (No Action)

Direct, Indirect and Cumulative Effects

Alternative A would not provide any additional economic benefits, beyond what is occurring now, to help provide employment and generate revenues in this portion of eastern Tennessee. There would be no revenues or associated costs of a commercial timber sale with Alternative A. The No Action Alternative would have no cumulative effects on the local economy

Alternative B (Proposed Action)

Direct and Indirect Effects

Forest Service Manual 2432.22c requires a financial analysis of any timber sale of \$100,000 or more, to inform how expected revenues would cover expected costs. This alternative would produce approximately 3702 hundred cubic feet (CCF) of forest products, and provide an economically efficient timber harvest, benefiting the local economy, provide jobs and payments to local and federal governments. The alternative would also provide high quality sawtimber and pulpwood. The discounted cash flow analysis shows a positive Present Net Value of \$26,494 (Table 3z).

Table 3z¹: Benefits to Cost Ratio

Revenues and Costs	Alternative A	Alternative B	Alternative C
Revenues			
Timber	\$0	\$219,747	\$414,406
Recreation	0	0	0
Wildlife	0	0	0
Other	0	0	0

Total Present Revenues	0	\$219,747	\$414,406
Revenues and Costs	Alternative A	Alternative B	Alternative C
Costs			
Harvest Administration	\$0	\$37,020	\$72,190
Sale prep	0	92,550	180,475
Roads	0	18,404	29,404
Reforestation	0	42,822	40,382
Silvicultural Exams	0	2,457	2,317
Timber Stand Improvement	0	0	0
Total Present Costs	0	\$193,253	\$324,768
Present Net Value	0	\$26,494	\$89,638

¹ This table follows direction given in Forest Service Handbook (FSH) 2409.18,30 (USDA 1995). Some calculations used to arrive at the values in the table were derived using a computer spreadsheet (Project File).

Alternative C

Direct and Indirect Effects

This alternative would produce approximately 48% more forest products (7219 CCF) compared to Alternative B, and would provide an economically efficient timber harvest, benefiting the local economy. Jobs and payments to local and federal governments would be similarly increased. This alternative would provide a positive impact on the local economy by providing some sawtimber and pulpwood. The discounted cash flow analysis shows a positive Present Net Value of \$89,638 (Table 3z).

Cumulative Effects for Alternatives B and C

The beneficial effects of previous timber sales on the local economy would have generally been exhausted by the time of implementation, and no additional sales are expected from this area in the near future. There would be no cumulative effects with implementation of these alternatives.

Chapter 4: References Cited

- Adams, T and D. Hook. 1993. Implementation and Effectiveness Monitoring of Forestry Best Management Practices on Harvested Sites in South Carolina. South Carolina Forestry Commission. Columbia, South Carolina.
- Adams, T. 1994. Implementation Monitoring of Forestry Best Management Practices on Harvested Sites in South Carolina with emphasis on BMP compliance in the Blue Ridge Mountains. South Carolina Forestry Commission. Columbia, South Carolina.
- Anderson C. and B. Lockaby. 2011. The Effectiveness of Forestry Best Management Practices for Sediment Control in the Southeastern United States: A Literature Review. Southern Journal of Applied Forestry. 35 (4)
- Artman, V.L., E.K Sutherland, and J.F. Downhower. 2001. Prescribed Burning to Restore Mixed-Oak Communities in Southern Ohio: Effects on Breeding-Bird Populations. Conservation Biology: Vol. 15, No. 5 (Oct., 2001) (pp. 1423-1434). Website accessed: <http://www.jstor.org/stable/info/3061498>.
- Ash, A.N. 1997. Disappearance and return of Plethodontid salamanders to clear-cut plots in the southern Blue Ridge Mountains. Conservation Biology 11(4):983-989.
- Biebighauser, Thomas R. 2003. A Guide to Creating Vernal Ponds. USDA Forest Service. pp. 3-4.
- Birdsey, R., K. Pregitzer, and A. Lucier. 2006. Forest Carbon Management in the United States: 1600-2100. J. Environ. Quality 35:1461-1469.
- Birdsey, R.; Jenkins, J.; Johnston, M.; Huber-Sannwald, E.; 2007. North American Forests. In King, A.; Dilling, L.; Zimmerman, G.; Fairman, D.; Houghton, R.; Marland, G.; Rose, A.Z.; Wilbanks, T.; eds. The First State of the Carbon Cycle Report (SOCCR): The North American carbon budget and implications for the global carbon cycle, a report by the US Climate Change Science Program and the Subcommittee on Global Change Research, National Oceanic and Atmospheric Administration, Asheville, NC; National Climatic Data Center: 117-126.
- Buchwalter, D. et al. 1996. Fact Sheet for Imazapyr and Forestry Use. Agricultural Chemistry Research and Extension Department. Oregon State University.
- Bull, Evelyn L. and Jerome A. Jackson. 1995. Pileated Woodpecker (*Dryocopus pileatus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: <http://bna.birds.cornell.edu/bna/species/148>.
- Burch, J.B. and T.A. Pearce. 1990. Terrestrial Gastropoda. Pp. 201-309. In: Dindal Daniel L. (ed.), Soil biology guide. pp. 201-204.

- Canadell, J.G., D.E. Pataki, R. Gifford, R.A. Houghton, Y. Luo, M.R. Raupach, P. Smith, W. Steffen. 2007. Saturation of the Terrestrial Carbon Sink. *In* Canadell JG, Pataki D, Pitelka L (eds) Terrestrial Ecosystems in a Changing World. The IGBP Series, Springer-Verlag, Berlin Heidelberg, pp. 59-78.
- Carter, Marcia S. 2013. Biological Assessment for Stony Creek Project. May 8, 2013.
- Carter, Marcia S and J.H. McGuinness. 2013. Biological Evaluation for Activities Related to Wildlife Habitat, Forest Management, and Roads: Stony Creek Project. June 19, 2013.
- Chapin, F.S.; Woodwell, G.M.; Randerson, J.T.; Rastetter, E.B.; Lovett, G.M.; Baldocchi, D.D.; Clark, D.A.; Harmon, M.E.; Schimel, D.S.; Valentini, R.; Wirth, C.; Aber, J.D.; Cole, J.J.; Goulden, M.L.; Harden, J.W.; Heimann, M.; Howarth, R.W.; Matson, P.A.; McGuire, A.D.; Melillo, J.M.; Mooney, H.A.; Neff, J.C.; Houghton, R.A.; Pace, M.L.; Ryan, M.G.; Running, S.W.; Sala, O.E.; Schlesinger, W.H.; Schulze, E.-D. 2006. Reconciling Carbon-cycle Concepts, Terminology, and Methods. *Ecosystems* 9: 1041-150.
- Cherokee National Forest. 2004a. Appendices, Final Environmental Impact Statement for the Revised Land and Resource Management Plan. pp.274-303, 332-340.
- Cherokee National Forest. 2004b. Final Environmental Impact Statement for the Revised Land and Resource Management Plan. pp.65, 198-199.
- Cherokee National Forest. 2004c. Revised Land and Resource Management Plan. p. 159.
- Douglas, James, and Swank, Wayne. 1972. Streamflow Modification Through Management of Eastern Forests. Southeast Forest Exp. Station, USDA Forest Service Research Paper SE-94, 15 pp.
- Elliot, Katherine J. and James M. Vose. 2005. Initial effects of prescribed fire on quality of soil solution and stream water in the Southern Appalachian Mountains. *South. J. Appl. For.* 29(1):5-15. Available: <http://www.srs.fs.usda.gov/pubs/9444>.
- Elliot, Katherine J. and James M. Vose. 2006. Fire effects on water quality: A synthesis of response regulating factors among contrasting ecosystems. USDA SRS Coweeta Hydrologic Laboratory. Second Interagency Conference on Research in the Watersheds. Available: <http://coweeta.uga.edu/publications/3058.pdf>.
- Federal Emergency Management Agency, DFIRM Flood Mapping (<https://hazards.fema.gov/wps/portal/mapviewer>) [Accessed June 11, 2012]
- Filipek, S.P. 1993. Timber Harvest. Impacts on Warmwater Streams: Guidelines for Evaluation: 227-239.
- Flora of North America Editorial Committee. 2002. Flora of North America. Oxford University Press. New York, New York. FNA Vol. 23, pages 448.

- Heath, L.S. and J.E. Smith, 2004. Criterion 5, Indicator 26: Total forest ecosystem biomass and carbon pool, and if appropriate, by forest type, age class and successional change. *In*: Data Report: A Supplement to the National Report on Sustainable Forests, 2003 [Darr, D.R. (coord.)]. FS-766A, U.S. Dept. of Agriculture, Wash. DC, 14 pp. Website: www.fs.fed.us/research/sustain/contents.htm
- Mallipudi, N. M., S. J. Stout, A. R. daCunha, and A. Lee. 1991. Photolysis of imazapyr (AC 243997) herbicide in aqueous media. *J. Agric. Food Chem.* 39(2):412-417.
- Maxwell, J.R.; Neary, D.G. 1991. Vegetation management effects on sediment yields. pp. 12-55 to 12-63, *In*: T. Shou-Shou and K. Yung-Huang (eds.) Proceedings of the 5th Federal Interagency Sediment Conference, Vol. 2. March 18-21, 1991, Las Vegas, NV, Federal Energy Regulatory Commission, Washington, D.C.
- McGuinness, J.H. 2013. Stony Creek Rare Plant Analysis by Survey Site.
- Miller, J.H., Chambliss, E. B., and N. J. Lowenstein. 2010. A Field Guide for the Identification of Invasive Plants in Southern Forests. USDA Forest Service, Southern Research Station. General Technical Report SRS-119. p.1.
- Mowbray, Thomas B. 1999. Scarlet Tanager (*Piranga olivacea*), *The Birds of North America Online* (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: <http://bna.birds.cornell.edu/bna/species/479>.
- National Assessment Synthesis Team. 2001. Climate Change Impacts on the United States: The Potential Consequences of Climate Variability and Change, Report for the U.S. Global Change Research Program, Cambridge Univ. Press, Cambridge, UK. 620 pp.
- National Wetlands Inventory. 2013. <http://www.fws.gov/wetlands/index.html>. [Accessed April 6, 2013].
- Natural Resources Conservation Service (NRCS). 2013a. Temperature and Precipitation Summary (TAPS) for Carter County, Tennessee. <http://www.wcc.nrcs.usda.gov/climate/foguide.html#taps>. [Accessed 4/6/2013]
- Natural Resources Conservation Service. 2013b. U.S. General Soil Map (STATSGO2). Available online at <http://soildatamart.nrcs.usda.gov>. [Accessed April 6, 2013]
- NatureServe. 2012. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer>.
- Neary, D.G. and J.L. Michael. 1996. Herbicides - protecting long-term sustainability and water quality in forest ecosystems. *New Zealand Journal of Forestry Science* 26:241-264.
- Nicholson, C.P. 1997. Atlas of the Breeding Birds of Tennessee. University of Tennessee Press, Knoxville.

- Ogden, L. J. and B. J. Stutchbury. 1994. Hooded Warbler (*Wilsonia citrina*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: <http://bna.birds.cornell.edu/bna/species/110>.
- O'Keefe, Joy. 2011. Assistant Professor, Department of Biology, Indiana State University, pers. comm. October 11, 2011.
- Pacala, R.; Birdsey, R.A.; Bridgham, S.D.; Conant, R.T.; Davis, K.; Hales, B.; Houghton, R.A.; Jenkins, J.C.; Johnston, M.; Marland, G.; Paustian, K. 2007. The North American carbon budget past and present. In King, A.W.; Dilling, L.; Zimmerman, G.P.; Fairman, D.M.; Houghton, R.A.; Marland, G.; Rose, A.Z.; Wilbanks, T.J.; eds. The First State of the Carbon Cycle Report (SOCCR): The North American carbon budget and implications for the global carbon cycle, a report by the US Climate Change Science Program and the Subcommittee on Global Change Research, National Oceanic and Atmospheric Administration, Asheville, NC; National Climatic Data Center: 117-126.
- Patric, J.H. October, 1976. Soil Erosion in the Eastern Forest. Journal of Forestry. Pages 671-677.
- Pregitzer, K.S. and Euskirchen, E.S. 2004. Carbon cycling and storage in world forests: biome patterns related to forest age. Global Change Biology 10: 2052-2077.
- Reid, L.M., and T. Dunne. 1984. Sediment production from forest road surfaces. Water Resources Research 20; 1753-1761.
- Richardson, Michael and Daniel W. Brauning. 1995. Chestnut-sided Warbler (*Dendroica pensylvanica*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: <http://bna.birds.cornell.edu/bna/species/190>.
- Riedell M. 2004. Forest Road Erosion Research at the Coweeta Hydrologic Laboratory. Proceedings of the Forest Service National Earth Sciences Conference, San Diego, Ca.
- Riedel, M., Swift, L. W., Vose, J.M., and Clinton, B.D. 2004. Forest Road Erosion Research at the Coweeta Hydrologic Laboratory. Proceedings of the Forest Service National Earth Sciences Conference, San Diego, CA. 18-22 October 2004.
- Rosgen, D.L. 1996. Applied River Morphology: Second Edition. Wildland Hydrology. pp. 4-9, 5-5, and 5-6.
- Rosgen, D.L. 2012. Course Book: Short Course on Applied Fluvial Geomorphology, Asheville, North Carolina, February 6-12, 2012, p. Applications 1.
- Sedell, J.R. 1981. Fish Habitat and Streamside Management: Past and Present. Proceedings of the Technical Session of the Effects of Forest Practices on Fish and Wildlife Production: 41-52.
- Strange, R.J., J.W. Habera. 1995. Wild Trout Project Annual Report, 1994. University of Tennessee and Tennessee Wildlife Resources Agency.

- Swank, W.T. et al. 1982. Changes in water yield and storm hydrograph following commercial clear cutting on a southern Appalachian catchment. P. 583-594 in Hydrological research basins and their use in water resource planning: Symposium proceedings. National Hydrological Service, Bern, Switzerland.
- Swank, W.T., DeBano, L., and Nelson, D. 1989. Effects of Timber Management Practices on Soil and Water. Pages 79-106. From the Scientific Basis for Silvicultural and Management Decisions in National Forest System. General Technical Report WO-55.
- Swank, W.T., Vose, J.M., and Elliot, K.J. 2001. Long-Term Hydrologic and Water Quality Responses Following Commercial Clear-cutting of Mixed Hardwoods on a Southern Appalachian Catchment. *Forest Ecology and Management* 143, pages 163-178, 2001.
- Syracuse Environmental Research Associates (SERA), Inc. 2004. Imazapyr (Arsenal, Chopper, and Stalker Formulations) Final Report. Task No. 14. SERA TR 98-21-14-01b.
- Syracuse Environmental Research Associates (SERA), Inc. 2003. Glyphosate – Human Health and Ecological Risk Assessment Final Report. Task No. 9. SERA TR 02-43-09-04a.
- Syracuse Environmental Research Associates (SERA), Inc. 2003. Triclopyr – Revised Human Health and Ecological Risk Assessment Final Report. Task No. 13. SERA TR 02-43-13-03b.
- Tennessee Department of Agriculture, Division of Forestry. 2003. Guide to Forestry Best Management Practices.
- Tennessee Department of Environment and Conservation (TDEC), Division of Water Pollution Control. 2000. Tennessee Ecoregion Project. December 2000. p.88.
- Tennessee Department of Environment and Conservation . 2007a. Rules of Tennessee Department of Environment and Conservation, Division of Water Pollution Control, Chapter 1200-4-4, Use Classifications for Surface Waters. Effective Date October 6, 2007. 34p. (<http://tn.gov/sos/rules/1200/1200-04/1200-04-04.pdf> , p.26)
- Tennessee Department of Environment and Conservation . 2007b. Rules of Tennessee Department of Environment and Conservation, Tennessee Water Quality Control Board, Chapter 1200-04-03, General Water Quality Criteria. Effective Date: July 23, 2007. 43p. (<http://www.tn.gov/sos/rules/1200/1200-04/1200-04-03.20110531.pdf>. p.29)
- Tennessee Department of Environment and Conservation . 2013. TDEC Assessment Interactive Mapper. <http://tnmap.tn.gov/wpc/default.aspx/resetSession=true>. [Accessed 4/6/2013]
- Tennessee Department of Environment and Conservation. 2012. Tennessee Heritage Program Rare Plant List. p. 24. Available at http://state.tn.us/environment/na/pdf/plant_list.pdf
- Thomas, J. 2012. Distribution and Life History of MIS and Demand Species of the Cherokee National Forest.

- Trout Unlimited. 2006. Eastern brook trout: status and threats, Tennessee and North Carolina. EBTJV (Eastern Brook Trout Joint Venture). State brochures. Arlington, Virginia. 2 p. Available online: http://www.easternbrooktrout.org/docs/brookie_TN-NC.pdf.
- Tu I.M., Hurd C.C., and Randall J.M. 2001. Weed Control Methods Handbook: Tools and Techniques for Use in Natural Areas. Arlington (VA): The Nature Conservancy. (18 July 2003; <http://tncweeds.ucdavis.edu/handbook.html>)
- USDA, Environmental Protection Agency, Inventory Of U.S. Greenhouse Gas Emissions And Sinks: 1990 – 2007, March 2008 Public Review Draft.
- USDA, Forest Service. 1989. (VMEIS) Vegetation Management in the Appalachian Mountains, Final Environmental Impact Statement. Atlanta, GA: U.S. Department of Agriculture, Forest Service, Southern Region. Vol. II Appendices Pages 3-5, Volume II Appendices Supplement 1, pages 1-10.
- USDA, Forest Service. 1997. Guidance for Conserving and Restoring Old-Growth Forest Communities on National Forests in the Southern Region. Report of the Region 8 Old-Growth Team. Southern Region, Atlanta, GA. Forestry Report R8-FR 62. pp. 122.
- USDA, Forest Service. 2004a. Cherokee National Forest Revised Land and Resource Management Plan.
- USDA, Forest Service 2004b. Final Environmental Impact Statement for the Cherokee National Forest Revised Land and Resource Management Plan. Cleveland, TN.
- USDA, Forest Service. 2010. Stony Creek Watershed Assessment Area, Travel Analysis Process Report, v.7.26.2010. Cherokee National Forest, Watauga Ranger District.
- U.S. Global Change Research Program, National Assessment Synthesis Team. 2001. *Climate change impacts on the United States – the potential consequences of climate variability and change*. United Kingdom: Cambridge University Press, 612 pp.
- Van Horn, M. A. and T.M. Donovan. 1994. Ovenbird (*Seiurus aurocapilla*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: <http://bna.birds.cornell.edu/bna/species/088>.
- Whitaker Jr., J.O. and W.J. Hamilton, Jr. 1998. Mammals of the Eastern United States. Cornell University Press. Ithaca , NY.

Chapter 5: List of Preparers

Team Leader

Jeff Chynoweth (NEPA Planner): NEPA

Team Members

Marcia Carter (Fisheries Biologist): Terrestrial/Aquatic Fauna, TES, MIS, Demand, Rare Species

Alice Cohen (NRTPM): Recreation

Matt Fusco (Landscape Architect): Scenery Resources

Jeff Kincaid (Forester): Forest Resources

Joe McGuinness (Wildlife Biologist): Terrestrial Flora, TES, MIS, Rare Species

Stephanie Medlin (Forest NEPA Coordinator): NEPA, Climate Change

Allison Reddington (Forest Hydrologist): Soil and Water

Thomas Scott (Fisheries Biologist): Aquatics

Jim Stelick (Vegetation Management Program Mgr.): Vegetation Mgt, Pesticide Use, Economics

Chris Stoeckel (Botanist): Terrestrial Flora

Gary Watson (Engineering Technician): Transportation System, Roads